United States Government Accountability Office

Report to the Ranking Member, Committee on Homeland Security and Governmental Affairs, United States Senate

December 2020

RURAL HOSPITAL CLOSURES

Affected Residents Had Reduced Access to Health Care Services

GAO-21-93

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GAO Highlights

Highlights of GAO-21-93, a report to the Ranking Member, Committee on Homeland Security and Governmental Affairs, United States Senate

Why GAO Did This Study

Rural hospitals face many challenges in providing essential access to health care services to rural communities. From January 2013 through February 2020, 101 rural hospitals closed.

GAO was asked to examine the effects of rural hospital closures on residents living in the areas of the hospitals that closed. This report examines, among other objectives, how closures affected the distance for residents to access health care services, as well as changes in the availability of health care providers in counties with and without closures.

GAO analyzed data from the Department of Health and Human Services (HHS) and the North Carolina Rural Health Research Program (NC RHRP) for rural hospitals (1) that closed and those that were open during the years 2013 through 2017, and (2) for which complete data generally were available at the time of GAO's review. GAO also interviewed HHS and NC RHRP officials and reviewed relevant literature.

GAO defined hospitals as rural according to data from the Federal Office of Rural Health Policy. GAO defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP. GAO defined service areas with closures as the collection of ZIP Codes that were served by closed rural hospitals and service areas without closures as the collection of ZIP Codes served only by rural hospitals that were open.

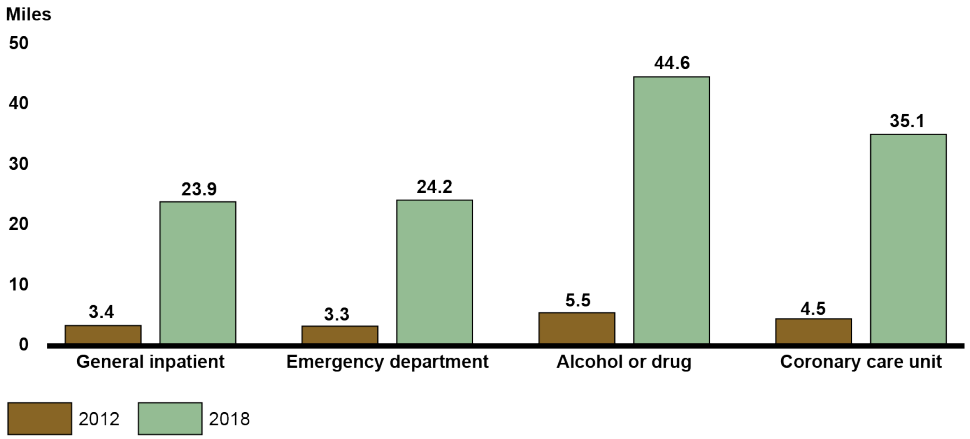
GAO provided a draft of this report to HHS for comment. The Department provided technical comments, which GAO incorporated as appropriate.

View GAO-21-93. For more information, contact James Cosgrove at (202) 512-7114 or cosgrovej@gao.gov.

What GAO Found

GAO found that when rural hospitals closed, residents living in the closed hospitals' service areas would have to travel substantially farther to access certain health care services. Specifically, for residents living in these service areas, GAO's analysis shows that the median distance to access some of the more common health care services increased about 20 miles from 2012 to 2018. For example, the median distance to access general inpatient services was 3.4 miles in 2012, compared to 23.9 miles in 2018—an increase of 20.5 miles. For some of the less common services that were offered by a few of the hospitals that closed, this median distance increased much more. For example, among residents in the service areas of the 11 closed hospitals that offered treatment services for alcohol or drug abuse, the median distance was 5.5 miles in 2012, compared to 44.6 miles in 2018—an increase of 39.1 miles to access these services (see figure).

Median Distance in Miles from Service Areas with Rural Hospital Closures to the Nearest Open Hospital that Offered Certain Health Care Services, 2012 and 2018



Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program. | GAO-21-93

Notes: GAO focused its analysis on the health care services offered in 2012 by the 64 rural hospitals that closed during the years 2013 through 2017 and for which data were available. For example, in 2012, 64 closed hospitals offered general inpatient services, 62 offered emergency department services, 11 offered treatment services for alcohol or drug abuse, and 11 offered services in a coronary care unit. To examine distance, GAO calculated "crow-fly miles" (the distance measured in a straight line) from the geographic center of each closed rural hospital's service area to the geographic center of the ZIP Code with the nearest open rural or urban hospital that offered a given service.

GAO also found that the availability of health care providers in counties with rural hospital closures generally was lower and declined more over time, compared to those without closures. Specifically, counties with closures generally had fewer health care professionals per 100,000 residents in 2012 than did counties without closures. The disparities in the availability of health care professionals in these counties grew from 2012 to 2017. For example, over this time period, the availability of physicians declined more among counties with closures—dropping from a median of 71.2 to 59.7 per 100,000 residents—compared to counties without closures—which dropped from 87.5 to 86.3 per 100,000 residents.

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Abbreviations

CMS	Centers for Medicare & Medicaid Services
FFS	fee-for-service
HHS	Department of Health and Human Services
HRSA	Health Resources and Services Administration
NC RHRP	North Carolina Rural Health Research Program
ZCTA	ZIP Code tabulation area

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

December 22, 2020

The Honorable Gary C. Peters
Ranking Member
Committee on Homeland Security
and Governmental Affairs
United States Senate

Dear Mr. Peters:

Rural hospitals face many challenges in providing essential access to health care services to rural communities. As we reported in 2018, rural hospital closures during the years 2013 through 2017 more than doubled compared with the previous 5-year period.[1] We also reported that more rural hospitals closed than urban hospitals during these years.

Research has shown that rural hospital closures can affect residents' access to both inpatient and outpatient health care services. However, less is known about the effects of closures on certain aspects of access, such as the distance for residents to obtain health care services after a hospital closure in their area, or the availability of health care providers in an area after a closure.

Given the number of rural hospital closures, you asked us to examine the effects of closures on residents in these areas. This report describes

1. changes in the availability of health care providers in counties with and without rural hospital closures,
2. the effect of closures on the distance for residents to access health care services,
3. health characteristics of Medicare fee-for-service (FFS) beneficiaries in service areas with and without closures, and
4. financial health and other characteristics of recently closed and open rural hospitals.

To identify recently closed and open rural hospitals, we first identified general acute care hospitals using the Provider of Services files from the

[1]See GAO, *Rural Hospital Closures: Number and Characteristics of Affected Hospitals and Contributing Factors*, GAO-18-634 (Washington, D.C.: Aug. 29, 2018).

Centers for Medicare & Medicaid Services (CMS), an agency within the Department of Health and Human Services (HHS).[2] We identified a hospital as rural if its ZIP Code was considered rural by the Federal Office of Rural Health Policy within HHS's Health Resources and Services Administration (HRSA).[3] We determined hospital closures by using data from the North Carolina Rural Health Research Program (NC RHRP), which conducts research funded by HHS's Federal Office of Rural Health Policy.[4] We considered all other rural hospitals as open. We focused our analysis on the 65 rural hospitals that closed and 2,160 hospitals that were open during the years 2013 through 2017, for which complete data generally were available at the time of our review.[5]

We identified the service areas of recently closed and open rural hospitals, using CMS's Hospital Service Area Files. We configured two mutually exclusive study groups: (1) service areas with rural hospital closures and (2) service areas without closures. We defined service areas with closures as the collection of ZIP Codes that were served by closed rural hospitals. If a ZIP Code was served by both a closed hospital and an open hospital, it was included in the "service areas with closures" study group. We defined service areas without closures as the collection of ZIP Codes served only by rural hospitals that were open.[6]

[2]For the purpose of our analysis, we excluded hospitals identified as: (i) Indian Health Services hospitals, (ii) emergency and federal hospitals, (iii) developmental centers and pre-long term acute care hospitals, (iv) specialty and cancer hospitals, and (v) hospitals located in U.S. territories.

[3]The Federal Office of Rural Health Policy identifies ZIP Codes as rural if they are in: (i) a non-metropolitan county; (ii) a metropolitan county, but with a Rural-Urban Commuting Area code of 4 or higher; or (iii) one of 132 large and sparsely populated census tracts with a Rural-Urban Commuting Area code of 2 or 3. The Rural-Urban Commuting Area codes are used by the U.S. Department of Agriculture to classify census tracts as urban or rural based on measures of population density, urbanization, and daily commuting.

[4]NC RHRP defines a hospital closure as cessation of inpatient services. These hospitals may have converted to other facility types, providing limited or different services, such as emergency care, outpatient care, primary care, or urgent care.

[5]For the purpose of our analysis, we included all rural hospitals open as of December 31, 2012. We excluded (i) rural hospitals that opened in or after 2013, including one hospital that opened in 2013 and closed in 2016; (ii) 36 rural hospitals that closed after 2017; and (iii) six rural hospitals that both closed and reopened from January 2013 through February 2020—the most recent data available at the time of our analysis.

[6]Service areas may have also been served by urban hospitals.

(See app. I for more information on how we identified service areas with and without closures.)

To describe the changes in the availability of health care providers in counties with and without rural hospital closures, we used HRSA's Area Health Resources Files for 2012 (the year prior to our closure study period) and 2017 (the last year of our closure study period and the most recent year with complete data at the time of our review). Again, we configured two mutually exclusive study groups: (1) counties with closures—that is, the collection of counties where closed rural hospitals were located—and (2) counties without closures—that is, the collection of counties where only open rural hospitals were located.[7]

To describe the effect of rural hospital closures on the distance for residents to access health care services, we used CMS data to identify services offered by open general acute care hospitals in 2012 (the year prior to our closure study period) and in 2018 (the year after our closure study period and the most recent year with complete data from these sources).[8] To examine distance, we calculated "crow-fly miles" (the distance measured in a straight line) from the geographic center of each closed rural hospital's service area to the geographic center of the ZIP Code with the nearest open rural or urban hospital that offered a given service in 2012 and in 2018. We identified the center of each closed hospital's service area by weighting the coordinates of the center of each service area ZIP Code by the percentage of inpatient cases that the ZIP Code contributed to the hospital's total number of cases within the service area.

To describe the health characteristics of Medicare FFS beneficiaries in service areas with and without rural hospital closures, we used data from the CMS Medicare Geographic Variation files to examine the prevalence of the 10 most common chronic conditions.[9] We examined the CMS data

[7]We excluded counties that had missing data. Counties may contain both rural and urban hospitals.

[8]We determined a hospital as open if it had at least one Medicare FFS inpatient case during that year. We focused our analysis on the health care services offered in 2012 by the closed rural hospitals for which data were available.

[9]These data were based on 100 percent of Medicare claims for Medicare FFS beneficiaries and did not include beneficiaries enrolled in Medicare Advantage, which provides health benefits through private health plans.

at the ZIP-Code level for 2017 (the last year of our closure study period and the most recent year with complete data).

To describe the financial health and other characteristics of recently closed and open rural hospitals, we used data from the CMS Provider of Services files and Medicare hospital cost reports to calculate total facility margins and to examine the number of inpatient beds and full-time employees. For closed rural hospitals, we examined data for 2012 (the year prior to our closure study period) and the most recent data available in the year immediately prior to closure. For open rural hospitals, we examined data for 2012 and 2017 (the most recent year with complete data).[10]

To assess the reliability of the CMS and HRSA data used for this report, we reviewed relevant documentation, interviewed knowledgeable officials from HHS and NC RHRP, and performed electronic data tests to check for missing data and consistency with other published data. We determined the data were reliable for the purposes of our report.

In addition, to identify more information on the characteristics of recently closed and open rural hospitals and the effect of these closures, we conducted a literature review. We identified peer-reviewed research studies through interviews with agency officials and by searching several bibliographic databases—including ProQuest, MEDLINE, and Scopus—using terms such as “rural hospital closures,” “residents,” “access to care,” “travel distance,” and “financial distress.” We identified 30 relevant studies published from January 2015 to April 2020 that met our standard for methodological rigor. We reviewed these studies to determine both appropriateness and overall quality of the research and interpreted their findings based on this review.

We conducted this performance audit from July 2019 through December 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

[10]For closed hospitals, the most recent data available in the year prior to closure could also include the date of closure. For these analyses, we excluded any closed and open hospitals with missing data.

Background

Rural Hospitals and Areas

Rural hospitals represented approximately 48 percent of hospitals nationwide in 2017. These hospitals were spread across the 84 percent of the U.S. land area that the Federal Office of Rural Health Policy classified as rural and served the 18 percent of the U.S. population who lived in these areas.[11]

Compared to their urban counterparts, rural residents generally are older and poorer. From 2012 through 2016, 18 percent of rural residents were 65 years or older, compared to 13 percent of urban residents. Moreover, 31 percent of rural counties, compared to 19 percent of urban counties, had concentrated poverty.[12] Research has shown that closures may have a disproportionate effect on certain residents—such as those who are elderly and low income—but less is known about other characteristics of residents who may be affected by closures.[13]

Rural areas have also experienced several changes in recent years that have exacerbated these differences. For example, according to research by the U.S. Department of Agriculture, rural areas have experienced the following changes:

- **Decreasing population.** From 2010 through 2018, the population in completely rural areas declined by nearly 2 percent, while the population in urban areas increased by nearly 7 percent.
- **Decreasing employment rate.** From 2010 through 2018, the employment rate in completely rural areas declined by 0.4 percent,

[11]See GAO-18-634. These estimates are of the 2010 Census. They are somewhat smaller than those classified as rural by the U.S. Census Bureau (95 percent of land area and 19 percent of population) and somewhat larger than those classified as rural by the Office of Management and Budget (72 percent and 15 percent, respectively). There are various ways to define a rural area, and no consistent definition is used across government programs. See Health Resources and Services Administration, *Defining Rural Population*, accessed October 5, 2020, https://www.hrsa.gov/rural-health/about-us/definition/index.html.

[12]See K. Parker et al., *What Unites and Divides Urban, Suburban and Rural Communities* (Washington, D.C.: Pew Research Center, May 2018). In this study, researchers defined counties with “concentrated poverty” as those where at least one-fifth of the population is poor.

[13]See J. Wishner et al., *A Look at Rural Hospital Closures and Implications for Access to Care: Three Case Studies* (Menlo Park, Calif.: Kaiser Family Foundation, 2016).

while the employment rate in urban areas increased by more than 4 percent.[14]

Rural Hospital Closures

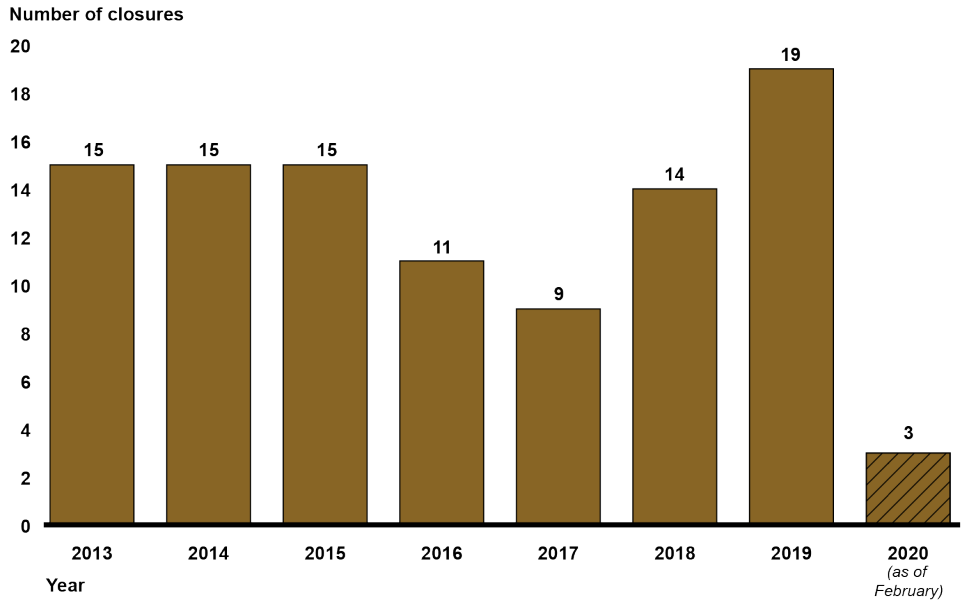
HHS data show that from January 2013 through February 2020, 101 of the approximately 2,260 rural hospitals in the United States that were open in 2013 closed (see fig. 1).[15] Closures occurred in 28 of the 50 U.S. states (see fig. 2).[16]

[14]See U.S. Department of Agriculture, Economic Research Service, *Rural America at a Glance*, Economic Information Bulletin 212 (Washington, D.C.: November 2019).

[15]The 101 hospitals that closed excluded six hospitals that both closed and reopened from January 2013 through February 2020; these closure numbers differ from those previously reported in GAO-18-634 because we used updated methodology and data (which includes removing hospitals that have closed and reopened since our previous report). February 2020 was the most recent data available at the time of our analysis and is prior to the World Health Organization's declaration of the Coronavirus Disease 2019 as a pandemic.

[16]There were no rural hospital closures in the District of Columbia.

Figure 1: Number of Annual Rural Hospital Closures from January 2013 through February 2020

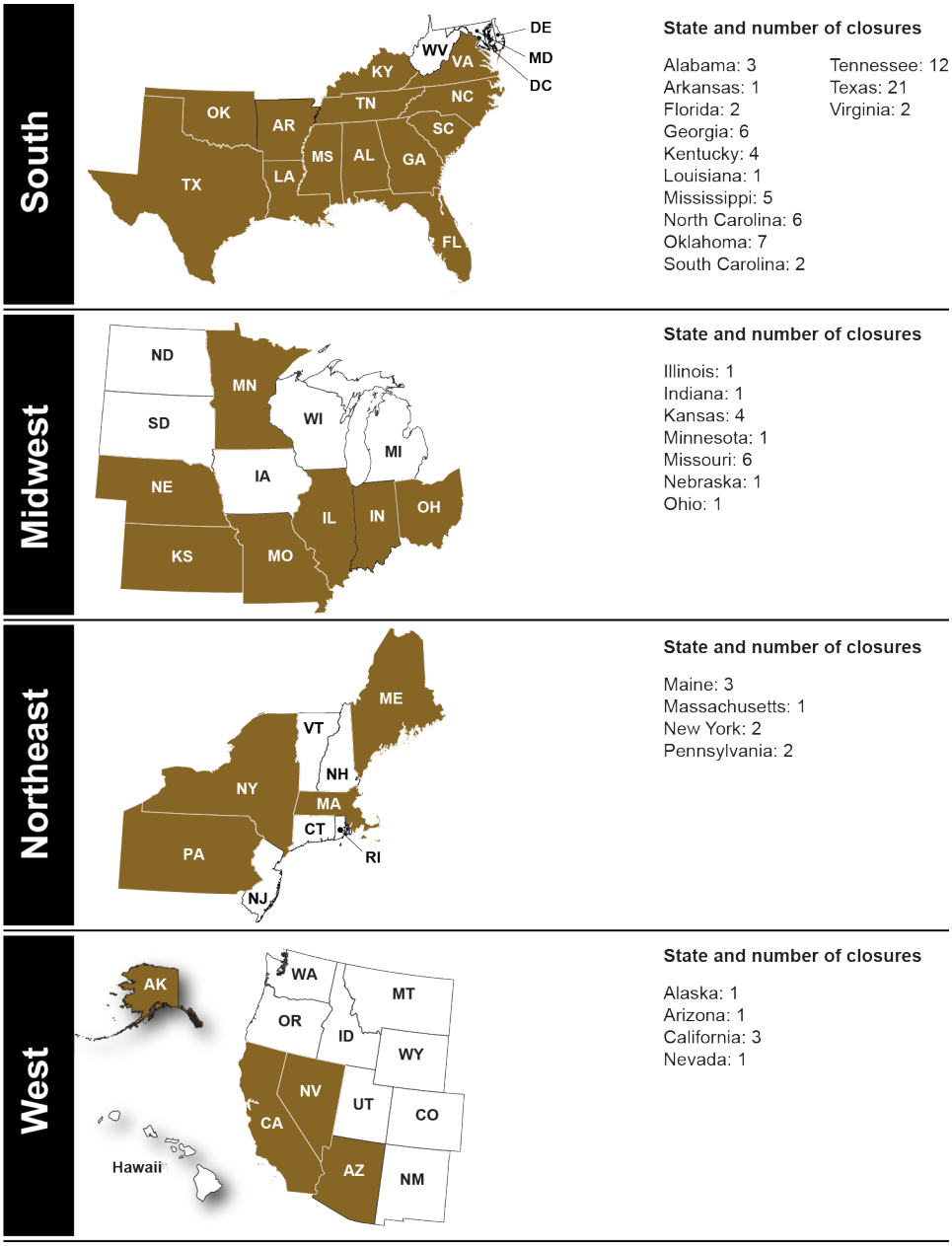


Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

Data for rural hospital closures are as of February 2020. These data excluded hospitals that closed and later reopened from January 2013 through February 2020.

Figure 2: Number of Rural Hospital Closures from January 2013 through February 2020, by Region and State



Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

Data for rural hospital closures are as of February 2020. These data excluded hospitals that closed and later reopened from January 2013 through February 2020.

The Availability of Health Care Providers in Counties with Rural Hospital Closures Generally was Lower, Compared to Those without Closures

The availability of health care providers—health care professionals and hospitals that offered certain health care services—in counties with rural hospital closures generally was lower and declined more over time, compared to counties without closures. However, patterns varied for other Medicare-certified facilities.

Counties with Rural Hospital Closures Generally Had Fewer Health Care Professionals in 2012 than Those without Closures, and Their Availability Further Declined from 2012 to 2017

Our analysis of HHS data found that counties with rural hospital closures generally had fewer health care professionals—physicians, physician assistants, and advanced practice registered nurses—per 100,000 residents than counties without closures.[17] For example, in 2012 (the year prior to our closure study period),

- the median number of all physicians in counties with closures was 71.2 per 100,000 residents, compared to 87.5 per 100,000 residents in counties without closures; and
- the median number of advanced practice registered nurses in counties with closures was 68.7 per 100,000 residents, compared to 77.9 per 100,000 residents in counties without closures.

[17]We focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. Physicians consist of active and non-federal doctors of medicine and doctors of osteopathic medicine who provided direct patient care, either in a hospital or office setting. We report on a select group of physician specialties that had data on both doctors of medicine and doctors of osteopathic medicine. Primary care physicians exclude hospital residents and physicians aged 75 or older. Physician assistants and advanced practice registered nurses are health care professionals who have completed graduate-level education and, depending on the specialty they choose, are trained to deliver a wide range of care. For the purpose of this report, we use “advanced practice registered nurses” to include advanced practice registered nurses, advanced practice nurse midwives, nurse practitioners, clinical nurse specialists, and certified registered nurse anesthetists.

However, there were some exceptions among certain physician specialties. For example, counties with rural hospital closures had slightly more obstetricians and internal medicine physicians per 100,000 residents in 2012, compared to counties without closures.

Furthermore, HHS data show that the disparities in the availability of health care professionals in counties with and without rural hospital closures grew from 2012 to 2017 (the last year of our closure study period). Although counties with and without closures generally saw reductions in the overall availability of health care professionals, those with closures generally experienced greater reductions or smaller increases compared to counties without closures.[18] For example, from 2012 to 2017, the availability of all physicians declined more among counties with closures (16.2 percent) compared to counties without closures (1.3 percent).

Advanced practice registered nurses were an exception to this pattern. Counties with rural hospital closures experienced a greater increase in the availability of advanced practice registered nurses (61.3 percent), compared to counties without closures (56.3 percent). Because advanced practice registered nurses can furnish some of the care provided by certain physicians, these health care professionals may help address potential gaps in care in rural areas with declining numbers of physicians.[19] See table 1 for more information on the median number of various types of health care professionals per 100,000 residents in counties with and without closures.

[18]We did not examine the reasons for these changes and cannot describe a causal relationship, if any, between rural hospital closures and the availability of health care professionals in these counties. In other words, we cannot say if closures caused the number of professionals to decline, if the declining number of professionals led to closures, or if other factors led to closures and the declining number of professionals.

[19]See GAO, *Physician Workforce: Locations and Types of Graduate Training Were Largely Unchanged, and Federal Efforts May Not Be Sufficient to Meet Needs*, GAO-17-411 (Washington, D.C.: May 25, 2017).

Table 1: Median Number of Health Care Professionals per 100,000 Residents in Counties with and without Rural Hospital Closures, 2012 and 2017

Type of health care professional	Counties with closures			Counties without closures		
	2012	2017	Percentage change (percent)	2012	2017	Percentage change (percent)
All physicians	71.2	59.7	-16.2	87.5	86.3	-1.3
General surgery	4.8	3.1	-36.4	5.1	4.8	-5.0
Obstetrics	4.8	3.9	-19.2	3.5	3.1	-9.7
Primary care	42.7	36.0	-15.8	50.3	48.3	-4.1
Internal medicine	14.0	11.9	-14.8	11.3	11.2	-0.5
Pediatrics	5.3	4.7	-10.7	4.9	4.9	-0.1
Emergency medicine	0.0	1.8	—	2.5	3.1	23.6
Physician assistant	10.8	14.3	31.5	16.4	21.9	33.8
Advanced practice registered nurse	68.7	110.8	61.3	77.9	121.8	56.3

Legend: — = not applicable because median value in 2012 was zero.

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. There were 63 counties with closures and 1,751 counties without closures; counties may have had more than one hospital. We excluded counties that had missing data.

The percentage change was calculated before values were rounded; thus, discrepancies may exist between these calculated values and the apparent percentage change between the rounded median values in the table.

One study has shown that the availability of physicians and the viability of hospitals are related. For example, a study by Germack, et al., found significant reductions in the availability of all physicians and primary care physicians in the years prior to and after closures.[20] In addition, the researchers found significant reductions in the availability of general surgeons (up to 6.9 percent annually) in the 4 years prior to closure and of primary care physicians (an average of 8.2 percent annually) in the 6 years after closure.

[20]See H. D. Germack, R. Kandrack, and G. R. Martsolf, “When Rural Hospitals Close, the Physician Workforce Goes,” *Health Affairs*, vol. 38, no. 12 (2019): pp. 2086–2094.

Counties with Rural Hospital Closures Generally Were Less Likely than Those without Closures to Have Hospitals with Certain Health Care Services; Patterns Varied for Other Medicare-Certified Facilities

Our analysis of HHS data also found that in 2012, counties with rural hospital closures generally were less likely than counties without closures to have hospitals that offered certain health care services.[21] For example, 57.1 percent of counties with closures had hospital-based outpatient care centers, compared to 68.0 percent of counties without closures. However, there were some exceptions. For example, a larger percentage of counties with closures had hospitals that offered inpatient treatment services for alcohol or drug abuse (7.9 percent) compared to counties without closures (5.4 percent).

HHS data show that from 2012 to 2017, the disparities in the availability of hospitals that offered certain health care services grew in counties with and without rural hospital closures. For example, the percentage of counties with closures that had hospital-based outpatient care centers declined 22.2 percentage points, compared to a reduction of 2.2 percentage points in counties without closures. In addition, the percentage of counties with closures that had hospitals that offered inpatient treatment services for alcohol or drug abuse declined 6.3 percentage points, while there was little change among counties without closures (see table 2).

Table 2: Percentage of Counties with and without Rural Hospital Closures and that Had Hospitals that Offered Certain Health Care Services, 2012 and 2017

In percent

	Counties with closures			Counties without closures		
Type of service offered at hospital	**2012**	**2017**	**Percentage point change**	**2012**	**2017**	**Percentage point change**
General medical/surgical care, adult	81.0	39.7	-41.3	85.6	80.7	-4.9
Emergency department	79.4	39.7	-39.7	85.3	80.0	-5.3
Outpatient surgery	71.4	36.5	-34.9	78.2	72.7	-5.5
Intensive care, medical/surgical	55.6	27.0	-28.6	54.4	47.1	-7.3
General medical/surgical care, pediatric	38.1	12.7	-25.4	43.7	37.1	-6.6
Outpatient care center, hospital-based	57.1	34.9	-22.2	68.0	65.8	-2.2
Obstetric care	44.4	27.0	-17.5	55.2	50.5	-4.7
Primary care department	30.2	17.5	-12.7	39.4	43.3	3.9
Transportation to health care services	19.0	9.5	-9.5	17.3	16.1	-1.2

[21]We report on a select group of hospital and other Medicare-certified facility types with certain services that are (i) typical of rural settings, (ii) atypical of rural settings, or (iii) known to have shortages in rural settings.

Type of service offered at hospital	Counties with closures			Counties without closures		
	2012	2017	Percentage point change	2012	2017	Percentage point change
Pain management program	25.4	15.9	-9.5	39.3	39.6	0.3
Alcohol or drug abuse care, inpatient	7.9	1.6	-6.3	5.4	4.7	-0.6
Chemotherapy	22.2	15.9	-6.3	42.8	40.0	-2.8
Intensive care, pediatric	7.9	4.8	-3.2	4.1	3.4	-0.7
Ambulance service	9.5	6.3	-3.2	21.8	20.0	-1.8
Alcoholism or chemical dependency service, outpatient	9.5	6.3	-3.2	7.4	7.4	0.1
Intensive care, neonatal	6.3	4.8	-1.6	6.4	5.4	-1.0
Outpatient care center, freestanding	15.9	14.3	-1.6	19.1	19.6	0.5
Mobile health service	4.8	4.8	0.0	6.6	6.5	-0.1
Urgent care center	12.7	12.7	0.0	21.0	22.6	1.5

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. There were 63 counties with closures and 1,751 counties without closures; counties may have had more than one hospital. We excluded counties that had missing data.

The percentage point change was calculated before values were rounded; thus, discrepancies may exist between these calculated values and the apparent difference between the rounded median values in the table.

The reductions in these hospitals from 2012 to 2017 may have affected residents' utilization of health care services. For example, HHS data show that from 2012 to 2017, the median rate of hospital outpatient visits per 1,000 Medicare FFS beneficiaries declined among those in service areas with rural hospital closures, but increased among those in service areas without closures (see app. II for more information on Medicare utilization of and spending on health care services in service areas with and without closures). The pattern of care in both service areas with and without closures is consistent with the national trend of rural areas shifting care from inpatient to outpatient services.[22]

We found that patterns varied for other Medicare-certified facilities in 2012. For example, HHS data show that a smaller percentage of counties with rural hospital closures had ambulatory surgery centers (17.5 percent) compared to counties without closures (19.6 percent). However, a larger

[22]See GAO, *Medicare: Information on Medicare-Dependent Hospitals*, GAO-20-300 (Washington, D.C.: Feb. 28, 2020).

percentage of counties with closures had rural health clinics (71.4 percent) compared to counties without closures (64.8 percent).

HHS data also show that from 2012 to 2017, counties with rural hospital closures generally experienced greater reductions or smaller increases in these other Medicare-certified facilities compared to counties without closures. For example, the percentage of counties with closures that had rural health clinics declined 9.5 percentage points from 2012 to 2017, while counties without closures experienced an increase of 4.4 percentage points (see table 3).

Table 3: Percentage of Counties with and without Rural Hospital Closures and that Had Other Medicare-Certified Facilities that Offered Certain Health Care Services, 2012 and 2017

In percent

	Counties with closures			Counties without closures		
Type of facility	2012	2017	Percentage point change	2012	2017	Percentage point change
Rural health clinic	71.4	61.9	-9.5	64.8	69.2	4.4
Community mental health center	9.5	3.2	-6.3	6.4	1.4	-5.0
Ambulatory surgery center	17.5	17.5	0.0	19.6	19.0	-0.6
Federally qualified health center	63.5	74.6	11.1	42.2	54.4	12.2

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. There were 63 counties with closures and 1,751 counties without closures; counties may have had more than one hospital. We excluded counties that had missing data.

The percentage point change was calculated before values were rounded; thus, discrepancies may exist between these calculated values and the apparent difference between the rounded median values in the table.

The Distance for Residents to Access Health Care Services Increased after Rural Hospital Closures

Our analysis of HHS data found that when rural hospitals closed, residents living in the closed hospitals' service areas would have to travel substantially farther to access certain health care services. Specifically, we found that the median distance increased about 20 miles from 2012 (the year prior to our closure study period) to 2018 (the year after our closure study period) for residents to access some of the more common health care services—that is, those offered by at least two-thirds of the

hospitals that closed.[23] For example, among residents in the service areas of the 62 closed hospitals that offered emergency department services, the median distance was 3.3 miles (as the crow flies) in 2012, compared to 24.2 miles in 2018—an increase of 20.9 miles.[24]

The median distance increased much more for residents to access some of the less common services—that is, those offered by less than one-third of the rural hospitals that closed. For example, among residents in the service areas of the 11 closed hospitals that offered treatment services for alcohol or drug abuse, the median distance was 5.5 miles in 2012, compared to 44.6 miles in 2018—an increase of 39.1 miles (see table 4).

[23]We focused our analysis on the health care services offered in 2012 by the 64 rural hospitals that closed during the years 2013 through 2017 and for which data were available. Our analysis reflected the distance to access health care services offered in hospital settings; we did not examine services that are otherwise offered in outpatient clinics or other Medicare-certified facilities. Our results reflected the median distance in 2012 and in 2018; thus, for residents in these service areas, the distances to access health care services may have been shorter or farther than reported here.

[24]For the purpose of this analysis, we used "crow-fly miles" (the distance measured in a straight line between two points) as a proxy for estimating the distance for residents to access health care services. Another study confirmed that crow-fly miles, travel distance, and travel time for nonemergency travel are highly correlated; however, crow-fly miles may not be an adequate proxy for travel distance for emergency responses, which are sensitive to small differences. See F. P. Boscoe, K. A. Henry, and M. S. Zdeb, "A Nationwide Comparison of Driving Distance Versus Straight-Line Distance to Hospitals," *Professional Geographer*, vol. 64, no. 2 (2012): pp. 1–12.

In addition, one study found that travel time (transport time in an ambulance) to a hospital with an emergency department increased after a rural hospital closed in a given area. Specifically, the average travel time in rural areas was 14.2 minutes prior to closure, compared to 25.1 minutes after closure—an increase of 10.9 minutes. See S. Troske and A. Davis, *Do Hospital Closures Affect Patient Time in an Ambulance?* (Lexington, Ky.: Rural & Underserved Health Research Center, 2019).

Table 4: Median Distance in Miles from Service Areas with Rural Hospital Closures to the Nearest Open Hospital that Offered Certain Health Care Services, 2012 and 2018

Type of health care service	Number of closed rural hospitals that had offered the service in 2012	Median distance, 2012	Median distance, 2018	Change in median distance
Clinical laboratory	64	3.4	24.1	20.6
General inpatient	64	3.4	23.9	20.5
Diagnostic radiology	64	3.4	23.9	20.5
Emergency department	62	3.3	24.2	20.9
Pharmacy	61	3.4	24.0	20.6
Dietary	59	3.2	23.5	20.3
Outpatient	58	3.2	24.1	20.9
Physical therapy	58	3.4	23.7	20.2
Respiratory care	56	3.3	23.6	20.3
Operating room	46	3.1	23.2	20.1
Computed tomography scan (commonly referred to as CT scan)	45	3.4	24.3	20.9
Anesthesia	45	3.2	23.0	19.8
Outpatient surgery	44	3.2	23.7	20.5
Social work	43	3.5	22.4	18.9
Postoperative recovery room	42	3.2	23.0	19.8
Surgery, inpatient	42	3.3	22.5	19.2
Occupational therapy	41	3.8	23.8	20.0
Speech pathology	40	3.7	23.5	19.8
Nuclear medicine[a]	32	3.6	23.9	20.3
Magnetic resonance imaging (commonly referred to as MRI)	31	3.8	23.8	20.0
Pediatrics	27	3.2	23.4	20.2
Outpatient rehabilitation	26	4.0	24.0	20.1
Medical surgical intensive care unit	24	3.6	21.3	17.7
Dental	17	2.4	36.0	33.6
Surgery, orthopedic	17	3.4	22.3	18.9
Surgery, ophthalmic	14	2.8	23.5	20.7
Commission on Accreditation of Rehabilitation Facilities inpatient rehabilitation	14	3.5	24.1	20.6
Obstetrics	13	3.5	22.8	19.3
Psychiatry, emergency	12	4.1	22.9	18.9
Alcohol or drug	11	5.5	44.6	39.1

Type of health care service	Number of closed rural hospitals that had offered the service in 2012	Median distance, 2012	Median distance, 2018	Change in median distance
Psychiatry, geriatric	11	3.4	39.9	36.5
Coronary care unit	11	4.5	35.1	30.5
Therapeutic radiology	11	3.4	32.6	29.2
Psychiatry, outpatient	10	5.0	45.7	40.8
Psychiatry, adult inpatient	10	2.6	27.1	24.5
Organ transplant, non-Medicare certified	9	2.5	34.8	32.3
Surgical intensive care unit	8	4.1	39.0	34.9
Neonatal nursery	7	2.5	32.9	30.4
Acute renal dialysis	7	2.9	28.2	25.3
Designated trauma center	7	4.5	24.8	20.3
Optometry	5	2.5	48.1	45.6
Audiology	5	3.8	44.6	40.8
Chemotherapy	5	3.4	22.8	19.4
Psychiatry, child or adolescent	4	4.0	46.2	42.3
Urgent care center	4	3.1	42.2	39.1
Surgery, reconstructive	4	3.3	28.1	24.8
Extracorporeal shockwave lithotripter[b]	4	3.4	15.9	12.5
Gerontological specialty[c]	3	3.6	26.5	22.8
Transplant center, Medicare certified	1	2.1	79.2	77.1
Pediatric intensive care unit	1	2.9	78.2	75.3
Psychiatry, forensic[d]	1	2.9	47.2	44.3
Cardiac catheterization lab	1	4.5	41.1	36.5
Neurosurgery	1	5.1	27.8	22.6
Positron emissions tomography scan (commonly referred to as PET scan)	1	2.9	11.9	9.0

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on the health care services offered in 2012 by the 64 rural, general acute care hospitals that closed during the years 2013 through 2017 and for which data were available. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

To examine distance, we calculated “crow-fly miles” (the distance measured in a straight line) from the geographic center of each closed rural hospital’s service area to the geographic center of the ZIP Code with the nearest open rural or urban hospital that offered a given service. We identified the center of each closed hospital’s service area by weighting the coordinates of the center of each service area ZIP Code by the percentage of inpatient cases that the ZIP Code contributed to the hospital’s total number of cases within the service area.

[a]Nuclear medicine uses radioactive material to diagnose or treat a variety of diseases and conditions.

[b]Extracorporeal shock wave lithotripsy is a non-invasive method of treating upper urinary tract kidney stones.

[c]Gerontological specialty services are those that are specific to older adults.

[d]Forensic psychiatric services are those provided to individuals, such as prisoners, who are in the custody of penal authorities.

Medicare FFS Beneficiaries in Service Areas with Rural Hospital Closures Were Less Healthy than Those in Service Areas without Closures

Our analysis of HHS data found that in 2017 (the last year of our closure study period), Medicare FFS beneficiaries in service areas with rural hospital closures were less healthy compared to those in service areas without closures.[25] Specifically, Medicare FFS beneficiaries in service areas with closures had a higher prevalence of all of the 10 most common chronic conditions, compared to those in service areas without closures.[26] For example, Medicare FFS beneficiaries in service areas with closures had a higher median prevalence of hypertension (high blood pressure) (62.0 percent), compared to those in service areas without closures (56.3 percent) (see table 5). We also examined demographic and socioeconomic characteristics of residents in these service areas (see app. III for further details).

[25]We focused our analysis on the 64 rural hospitals that closed and the 2,159 rural hospitals that were open during the years 2013 through 2017. For this analysis, we excluded hospitals that had missing data. We used ZIP Codes as our unit of analysis. Service areas with closures represent the collection of 389 ZIP Codes that were served by closed rural hospitals; service areas without closures represent the collection of 16,495 ZIP Codes served only by rural hospitals that were open. We excluded ZIP Codes with missing data (see app. I for further details).

[26]We focused our analysis on the 10 chronic conditions with the highest national prevalence rate among Medicare FFS beneficiaries in 2017. See Centers for Medicare & Medicaid Services, *Chronic Conditions*, accessed October 9, 2020, https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/CC_Main.

Table 5: Median Prevalence of Chronic Conditions among Medicare Fee-for-Service (FFS) Beneficiaries in Service Areas with and without Rural Hospital Closures, 2017

In percent

Type of chronic condition	Service areas with closures	Service areas without closures
Hypertension (high blood pressure)	62.0	56.3
Hyperlipidemia (high cholesterol)	46.2	42.6
Rheumatoid arthritis	34.6	31.7
Diabetes	29.3	26.3
Ischemic (coronary) heart disease	27.6	26.1
Chronic kidney disease	24.4	21.8
Depression	18.5	16.4
Congestive heart failure	15.6	13.7
Chronic obstructive pulmonary disease	14.1	12.5
Alzheimer's	10.5	9.0

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 64 rural hospitals that closed and the 2,159 rural hospitals that were open during the years 2013 through 2017. For this analysis, we excluded hospitals that had missing data. We used ZIP Codes as our unit of analysis. Service areas with closures represent the collection of 389 ZIP Codes that were served by closed rural hospitals; service areas without closures represent the collection of 16,495 ZIP Codes served only by rural hospitals that were open. We excluded ZIP Codes with missing data.

Data were limited to Medicare FFS beneficiaries.

Closed Rural Hospitals Appeared Financially Distressed in the Years Prior to Closure, and Open Rural Hospitals May Be Showing Similar Patterns

Our analysis of HHS data found that closed rural hospitals appeared financially distressed in the years prior to closure, operating under negative total facility margins.[27] Specifically, for hospitals that closed from 2014 through 2017, the median margin declined from -3.3 percent in 2012 (the year prior to our closure study period) to -13.8 percent in the year prior to closure—a reduction of 10.5 percentage points.[28] The total facility margin is one indicator used to predict the risk of financial distress.[29]

HHS data and NC RHRP's research indicate that open rural hospitals may also be showing signs of financial distress. Specifically, HHS data show that from 2012 to 2017, the median total facility margin among open rural hospitals declined 1 percentage point (see table 6). Consistent with our findings, NC RHRP's research found that the margins for rural hospitals have declined from 2016 through 2018, putting these hospitals at higher risk of financial distress.[30] Hospitals predicted to be at high risk of financial distress have a significantly higher probability of closing or reducing their services.[31] Moreover, the percentage of rural hospitals classified as high or mid-high risk of financial distress has increased over

[27]We focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. The total facility margin measures a hospital's costs relative to its revenue and is calculated as revenue minus costs divided by revenue. We included revenue and costs associated with all of a hospital's patients.

[28]We generally reported aggregated data for closed hospitals. However, for hospitals that closed in 2013, data for 2012 represent the year prior to closure; therefore, we reported their data separately from other closed hospitals. Among hospitals that closed in 2013, the median margin was -10.5 percent in 2012.

[29]NC RHRP predicts a hospital's risk of financial distress based on a number of factors, including the hospital's profitability (total margin). Hospitals are assigned to one of four risk levels of financial distress: high, mid-high, mid-low, or low. See B. Kaufman, G. Pink, and M. Holmes, *Prediction of Financial Distress among Rural Hospitals* (Chapel Hill, N.C.: North Carolina Rural Health Research Program, 2016).

[30]See A. W. Maxell, H. A. Howard, and G. H. Pink, *2016-18 Profitability of Urban and Rural Hospitals by Medicare Payment Classification* (Chapel Hill, N.C.: North Carolina Rural Health Research Program, 2020).

[31]See S. R. Thomas, G. H. Pink, and K. Reiter, *Trends in Risk of Financial Distress among Rural Hospitals from 2015 to 2019* (Chapel Hill, N.C.: North Carolina Rural Health Research Program, 2019).

the past 5 years—from 24 percent in 2015 to 26.2 percent in 2019.[32] NC RHRP's research also found that from 2015 to 2019, there were large increases in the percentage of rural hospitals at high risk of financial distress that were located in the South, which were consistent with the disproportionate share of closures among southern hospitals in recent years.[33] One study shows that rural hospitals may be more financially stressed during the Coronavirus Disease 2019 pandemic, as most are operating with a small amount of cash.[34]

Table 6: Median Total Facility Margin of Closed and Open Rural Hospitals, 2012, Year Prior to Closure, and 2017

In percent

	Closed, 2013	Closed, 2014–2017			Open		
	2012	2012	Year prior to closure	Percentage point change	2012	2017	Percentage point change
Total facility margin	**-10.5**	**-3.3**	**-13.8**	**-10.5**	**3.0**	**1.9**	**-1.0**

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. For hospitals that closed in 2013, data for 2012 represent the year prior to closure; therefore, we reported data for these hospitals separately from other closed hospitals. For these analyses, we excluded hospitals that had missing data.

Total facility margin measures a hospital's costs relative to its revenue and is calculated as revenue minus costs divided by revenue. We included revenue and costs associated with all of a hospital's patients.

The percentage point change was calculated before values were rounded; thus, discrepancies may exist between these calculated values and the apparent difference between the rounded median values in the table.

[32]For more information on the number and percentage of rural hospitals, by state, predicted to be at high or mid-high risk of financial distress in 2019, see S. R. Thomas, G. H. Pink, and K. Reiter, *Geographic Variation in the 2019 Risk of Financial Distress among Rural Hospitals* (Chapel Hill, N.C.: North Carolina Rural Health Research Program, 2019).

[33]See Thomas, Pink, and Reiter, *Trends in Risk of Financial Distress*. As we previously reported in GAO-18-634, rural hospitals located in the South represented 38 percent of the rural hospitals in 2013, but they accounted for 77 percent of the rural hospital closures during the years 2013 through 2017.

[34]Specifically, rural hospitals had enough cash on hand to operate a median of less than 80 days without additional revenue. See *Most Rural Hospitals Have Little Cash Going into COVID* (Chapel Hill, N.C.: North Carolina Rural Health Research Program, 2020).

Rural hospital closures have tangible effects on the number of inpatient hospital beds or full-time-employee equivalents that are available in these communities. HHS data show that rural communities have lost a total of 2,066 inpatient beds and 6,347 full-time-employee equivalents as a result of rural hospital closures during the years 2013 through 2017. In the year prior to closure, hospitals that closed from 2014 through 2017 had a median of 30 inpatient beds and 96 full-time-employee equivalents. For context, in 2017, open rural hospitals had a median of 25 inpatient beds and 179 full-time-employee equivalents (see table 7).

Table 7: Median Number of Inpatient Beds and Full-Time Employees of Closed and Open Rural Hospitals, 2012, Year Prior to Closure, and 2017

	Closed, 2013	Closed, 2014–2017		Open	
	2012	2012	Year prior to closure	2012	2017
Inpatient beds	25	33	30	25	25
Full-time employees	93	101	96	182	179

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 65 rural hospitals that closed and the 2,160 rural hospitals that were open during the years 2013 through 2017. For hospitals that closed in 2013, data for 2012 represent the year prior to closure; therefore, we reported data for these hospitals separately from other closed hospitals. For these analyses, we excluded hospitals that had missing data.

Agency Comments

We provided a draft of this report to HHS for comment. The Department provided technical comments, which we incorporated as appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees, the Secretary of HHS, the Administrator of CMS, the Administrator of HRSA, and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-7114 or CosgroveJ@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

Sincerely yours,

James Cosgrove
Director, Health Care

Appendix I: Identifying Service Areas with and without Rural Hospital Closures

To examine the characteristics of residents and the effects of rural hospital closures on residents' access to, utilization of, and spending on health care services, we identified service areas of rural hospitals that closed and those that were open during the years 2013 through 2017. We aggregated data from the Centers for Medicare & Medicaid Services' (CMS) Hospital Service Area Files from 2010 through 2012—the 3 years prior to our closure study period.[1] We used multiple years of data to account for the low number of Medicare inpatient cases per year, especially for closed rural hospitals.

We defined service areas as a collection of ZIP Codes

- that are in the top 75 percentile of a hospital's total cases—that is, ZIP Codes from which most of the hospital's patients originated—or
- for which a hospital serves at least 25 percent of the ZIP Code's total cases—that is, ZIP Codes in which residents relied on the hospital for care.

ZIP Codes that were more than 150 miles from a given hospital were excluded from its service area. The service area ZIP Codes did not need to be contiguous, and they remained constant throughout our analysis years (i.e., we compared the same set of ZIP Codes for 2012 and 2017).

We configured two mutually exclusive study groups: (1) service areas with rural hospital closures—that is, the collection of 389 ZIP Codes served by closed rural hospitals—and (2) service areas without closures—that is, the collection of 16,495 ZIP Codes served only by rural hospitals that were open.[2] Of the 65 rural hospitals that closed and 2,160 rural hospitals that were open during the years 2013 through 2017, we identified service areas for 64 closed hospitals and 2,159 open hospitals. We excluded one closed and one open hospital that did not have 2010 through 2012 data from CMS's Hospital Service Area Files. To configure mutually exclusive study groups, (i) a ZIP Code was only included once

[1]The Hospital Service Area Files are annual summaries of calendar year Medicare inpatient hospital fee-for-service claims data, summarized by hospital provider numbers and ZIP Codes of Medicare beneficiaries served. Data do not include beneficiaries enrolled in Medicare Advantage, which provides health benefits through private health plans.

[2]Rural hospitals in our analysis primarily served residents in rural ZIP Codes, although they also served residents in non-rural ZIP Codes. Over 80 percent of the ZIP Codes in service areas with and without closures were considered rural. Service areas may have also been served by urban hospitals.

per study group even if it was served by more than one hospital in that group; and (ii) if a ZIP Code was served by both a closed hospital and an open hospital, it was included in the "service areas with closures" study group.[3] For each analysis, we excluded any service area ZIP Codes with missing data (see table 8 for a summary of service area ZIP Codes from CMS's Medicare Geographic Variation files used in our analyses).

Table 8: Number of Zip Codes with Data Available in Service Areas with and without Rural Hospital Closures, by Variable from the Centers for Medicare & Medicaid Services' (CMS) Medicare Geographic Variation Files, 2012 and 2017

ZIP Codes in analysis	Service areas with closures N=386		Service areas without closures N=16,397	
	2012	2017	2012	2017
ZIP Codes available in CMS data[a]	385	380	16,394	16,189
Utilization/spending[b]	385	379	16,363	16,141
Emergency room visits	384	378	16,183	15,984
Readmission rate	383	375	16,002	15,820

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

[a]The total number of ZIP Codes available in the CMS data is based on the fee-for-service beneficiary count variable, which had no missing data.

[b]The number of ZIP Codes in our analyses related to utilization/spending applies to the following variables: utilization and spending of inpatient stays, outpatient visits, evaluation and management events, ambulance events, and Part B drugs; as well as chronic conditions.

In addition, to assess the characteristics of residents in service areas with and without rural hospital closures, we configured two mutually exclusive ZIP Code tabulation area (ZCTA) service area study groups: (1) service areas with closures—that is, the collection of 362 ZCTAs served by closed rural hospitals—and (2) service areas without closures—that is, the collection of 15,004 ZCTAs served only by rural hospitals that were open.[4] We used ZCTA data when ZIP Code data were not available, as is

[3]The ZIP Codes in the "service areas with closures" study group were served by the 64 closed rural hospitals and by 119 open rural hospitals. The ZIP Codes in the "service areas without closures" study group were served only by 2,156 rural hospitals that were open. There were three open rural hospitals that did not serve any ZIP Codes that were not already served by the closed rural hospitals.

[4]ZCTAs are the U.S. Census Bureau's generalized representations of U.S. Postal Service ZIP Codes. ZCTAs may be composed of one or more ZIP Codes. Service areas may have also been served by urban hospitals.

the case for the U.S. Census Bureau's American Community Survey 5-year summary files (2013–2017). In this case, we converted the service area ZIP Codes to their corresponding ZCTAs.[5] To configure mutually exclusive study groups, (i) a ZCTA was only included once per study group even if more than one ZIP Code in that group shared the same ZCTA; and (ii) if ZIP Codes from different study groups shared the same ZCTA, it was included in the "service areas with closures" study group. For each analysis, we excluded any service area ZCTAs with missing data (see table 9 for a summary of service area ZCTAs from Census's American Community Survey data used in our analyses).

Table 9: Number of Zip Code Tabulation Areas (ZCTA) with Data Available in Service Areas with and without Rural Hospital Closures, by Variable from the U.S. Census's American Community Survey Data, 2013–2017

ZCTAs in analysis	Service areas with closures N=362	Service areas without closures N=15,004
Number of residents	362	15,004
Race, ethnicity, age, and sex	359	14,943
Education	359	14,934
Employment status	358	14,843
Insurance coverage	358	14,931
Median family income in dollars	342	13,904
Income below poverty level	358	14,822

Source: GAO analysis of data from the U.S. Census Bureau, Department of Health and Human Services, and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

[5]Although the Census Bureau created ZCTAs, it does not release an official crosswalk between ZIP Codes and ZCTAs. Therefore, we used a ZIP-ZCTA crosswalk from the Uniform Data System Mapper, developed by the Health Resources and Services Administration and other non-federal organizations. The crosswalk is an approximation of ZIP Codes and their corresponding ZCTAs, as ZCTAs are not an exact geographic match to ZIP Codes.

Appendix II: Medicare Utilization of and Spending on Health Care Services in Service Areas with and without Rural Hospital Closures

To describe the Medicare utilization of and spending on health care services in service areas with and without rural hospitals that closed during the years 2013 through 2017, we used the Centers for Medicare & Medicaid Services' (CMS) Medicare Geographic Variation files on Medicare fee-for-service (FFS) beneficiaries for 2012 (the year prior to our closure study period) and 2017 (the last year of our closure study period and the most recent year with complete data).[1]

Medicare Utilization

Our analysis of HHS data found that utilization patterns of health care services varied among Medicare FFS beneficiaries in service areas with and without rural hospital closures. For example,

- In 2012, beneficiaries in service areas with closures had a higher median rate of inpatient stays (306 per 1,000 beneficiaries), compared to those in service areas without closures (274 per 1,000 beneficiaries). From 2012 to 2017, the median rate of inpatient stays declined among beneficiaries in service areas with and without closures, with a greater reduction occurring in service areas with closures (9.5 percent) compared to service areas without closures (8.0 percent).[2]
- In 2012, beneficiaries in service areas with closures had a lower median rate of outpatient visits (4,264 per 1,000 beneficiaries), compared to those in service areas without closures (4,760 per 1,000 beneficiaries). From 2012 to 2017, the median rate of outpatient visits declined 5.1 percent among beneficiaries in service areas with

[1]For the purpose of these analyses, we used ZIP Codes as our unit of analysis. Service areas with closures represent the collection of 389 ZIP Codes that were served by closed rural hospitals; service areas without closures represent the collection of 16,495 ZIP Codes served only by rural hospitals that were open. We excluded ZIP Codes with missing data (see app. I for more information).

Medicare utilization and spending can vary for reasons that are not attributable to practice patterns or willingness to seek care. To account for these factors, CMS modifies the data in two ways: (i) by standardizing Medicare's payment amounts to remove geographic differences in payment rates for individual services, and (ii) by adjusting for differences in beneficiaries' health using a risk-adjustment model that CMS uses to pay Medicare Advantage plans.

[2]As we previously reported in GAO-18-634, a declining rural population and the increased competition among rural hospitals for this smaller population have contributed to the decreased demand for inpatient care. Experts indicated that decreased demand for inpatient care likely contributed to financial distress and, in turn, hospital closures.

closures, but increased 8.9 percent among those in service areas without closures.

- In 2012, beneficiaries in service areas with closures had a higher median rate of emergency room visits (774 per 1,000 beneficiaries), compared to those in service areas with closures (644 per 1,000 beneficiaries).[3] From 2012 to 2017, the median rate of emergency room visits declined 4.2 percent among beneficiaries in service areas with closures, but increased 3.7 percent among those in service areas without closures.
- In 2012, beneficiaries in service areas with closures had a slightly higher median hospital readmission rate (17.5 percent), compared to those in service areas without closures (16.3 percent).[4] From 2012 to 2017, beneficiaries in service areas with and without closures experienced minimal changes in the median readmission rate (declined by 0.1 and 0.5 percentage points, respectively) (see table 10).[5]

[3]Emergency room visits include both outpatient visits (when the beneficiary was released from the outpatient setting) and inpatient visits (when the beneficiary was admitted to an inpatient setting).

[4]All-cause hospital 30-day readmission rate is calculated as the number of all readmissions that took place within 30 days of the initial discharge divided by the total number of admissions where the beneficiary was discharged alive.

[5]Other researchers also found that service areas with closures experienced a reduction in readmission rates compared to those without closures. However, the study concluded that there was no association between hospital closures and the worsening outcomes for those living in the local community. The definition of service areas differed between this study and our study. See K. E. Joynt et al., "Hospital Closures had no Measurable Impact on Local Hospitalization Rates or Mortality Rates, 2003-11," *Health Affairs*, vol. 34, no. 5 (2015): pp. 765–772.

Table 10: Median Medicare Fee-for-Service (FFS) Utilization in Service Areas with and without Rural Hospital Closures, 2012 and 2017

Type of service utilization	Service areas with closures			Service areas without closures		
	2012	2017	Percentage change (percent)	2012	2017	Percentage change (percent)
Inpatient, hospital (stays)	306	277	-9.5	274	252	-8.0
Outpatient, hospital (visits)	4,264	4,048	-5.1	4,760	5,185	8.9
Evaluation and management (events)	11,769	12,319	4.7	10,102	10,138	0.4
Ambulance (events)	369	384	4.1	236	250	5.9
Emergency room (visits)[a]	774	741	-4.2	644	668	3.7
Readmission (percent)[b]	17.5	17.4	-0.1	16.3	15.8	-0.5

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 64 rural hospitals that closed and the 2,159 rural hospitals that were open during the years 2013 through 2017. For this analysis, we excluded hospitals that had missing data. We used ZIP Codes as our unit of analysis. Service areas with closures represent the collection of 389 ZIP Codes that were served by closed rural hospitals; service areas without closures represent the collection of 16,495 ZIP Codes served only by rural hospitals that were open. We excluded ZIP Codes with missing data.

Data were limited to Medicare FFS beneficiaries. Utilization rates for inpatient stays, outpatient visits, evaluation and management events, ambulance events, and emergency room visits are expressed as the number of times the service was used per 1,000 Medicare FFS beneficiaries.

[a]Emergency room visits include both outpatient visits (when the beneficiary was released from the outpatient setting) and inpatient visits (when the beneficiary was admitted to an inpatient setting).

[b]All-cause hospital 30-day readmission rate is calculated as the number of all readmissions that took place within 30 days of the initial discharge divided by the total number of admissions where the beneficiary was discharged alive. Changes in readmission rates are calculated as percentage point change.

Medicare Spending

Our analysis of HHS data found that spending on health care services generally was slightly higher among Medicare FFS beneficiaries in service areas with rural hospital closures compared to those in service areas without closures.[6] For example, in 2012, the median total Medicare spending per capita was $9,943 among beneficiaries in service areas with closures, compared to $9,305 among those in service areas without closures.

HHS data show that from 2012 to 2017, the median Medicare spending per capita increased among FFS beneficiaries in service areas with and without rural hospital closures, but the percentage of increase varied by

[6]Spending measures were not inflation-adjusted and reflect dollars for the respective calendar year.

type of service. For example, the median Medicare spending per capita on inpatient services increased more among beneficiaries in service areas with closures (5.8 percent), compared to those in service areas without closures (3.0 percent). However, the median Medicare spending per capita on outpatient services increased less among beneficiaries in service areas with closures (29.1 percent), compared to those in service areas without closures (39.5 percent) (see table 11).

Table 11: Median Standardized Medicare Fee-for-Service (FFS) Spending per Capita in Service Areas with and without Rural Hospital Closures, by Health Care Service, 2012 and 2017

	Service areas with closures			Service areas without closures		
Type of service	2012	2017	Percentage change (percent)	2012	2017	Percentage change (percent)
Total spending[a]	$9,943	$10,245	3.0	$9,305	$9,979	7.2
Inpatient, hospital	2,612	2,762	5.8	2,427	2,501	3.0
Evaluation and management	798	863	8.2	665	689	3.7
Ambulance	129	164	26.7	86	114	33.7
Outpatient, hospital	1,204	1,554	29.1	1,250	1,744	39.5
Part B drug[b]	268	396	48.0	189	239	26.5

Source: GAO analysis of data from the Department of Health and Human Services and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 64 rural hospitals that closed and the 2,159 rural hospitals that were open during the years 2013 through 2017. For this analysis, we excluded hospitals that had missing data. We used ZIP Codes as our unit of analysis. Service areas with closures represent the collection of 389 ZIP Codes that were served by closed rural hospitals; service areas without closures represent the collection of 16,495 ZIP Codes served only by rural hospitals that were open. We excluded ZIP Codes with missing data.

Data were limited to Medicare FFS beneficiaries. Spending measures were not inflation-adjusted and reflect dollars for the respective calendar year.

[a]Standardized, risk-adjusted total Medicare FFS spending per capita.

[b]Part B drug is not considered a service; rather, the data were generated for the number and percentage of beneficiaries using prescription drugs that are covered under Medicare Part B.

Appendix III: Demographic and Socioeconomic Characteristics of Residents in Service Areas with and without Rural Hospital Closures

To describe the characteristics of residents in service areas with and without rural hospitals that closed during the years 2013 through 2017, we used data from the U.S. Census Bureau's American Community Survey. We examined Census data at the ZIP Code tabulation area (ZCTA) level for 2013–2017 (using 5-year summary files that aligned with our study period).[1]

Demographic Characteristics

Our analysis of Census and HHS data found that from 2013 through 2017, demographic characteristics generally appeared similar between service areas with and without rural hospital closures, with some exceptions.[2] For example, the median percentage of residents who were Black or African American was 2.7 percent in service areas with closures and 0.3 percent in service areas without closures (see table 12).

[1]Compared to single-year files, the 5-year files are more statistically reliable, particularly for small geographic areas and small population subgroups, such as rural areas.

ZCTAs are Census's generalized representations of U.S. Postal Service ZIP Codes. Service areas with closures represent the collection of 362 ZCTAs that were served by closed rural hospitals (serving approximately 2.7 million residents); service areas without closures represent the collection of 15,004 ZCTAs served only by rural hospitals that were open (serving approximately 92.3 million residents). In each analysis, we excluded ZCTAs with missing data.

[2]Consistent with our analysis, one study found that rural hospital closures may disproportionately affect racial and ethnic minorities. For example, researchers found that compared to other rural hospitals that remained open, closed rural hospitals were located in markets that had a higher percentage of Black and Hispanic residents. See S. R. Thomas, G. M. Holmes, and G. H. Pink, "To What Extent do Community Characteristics Explain Differences in Closure among Financially Distressed Rural Hospitals?," *Journal of Health Care for the Poor and Underserved*, vol. 27, no. 4A (2016): pp. 194–203.

Table 12: Median Percentages of Demographic Characteristics among Residents in Service Areas with and without Rural Hospital Closures, 2013–2017

In percent

Demographic characteristics	Service areas with closures	Service areas without closures
Race		
White	90.0	95.3
Black or African American	2.7	0.3
Asian, Native Hawaiian, or other Pacific Islander	0.1	0.0
American Indian or Alaska Native	0.1	0.0
Other, including two or more races	2.2	1.8
Ethnicity		
Hispanic origin	2.5	2.0
Age		
Under 18 years	21.5	21.7
Between 18 and 64 years	59.5	58.8
65 years or older	18.2	18.6
Sex		
Female	50.4	50.1
Male	49.6	49.9

Source: GAO analysis of data from the U.S. Census Bureau, Department of Health and Human Services, and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

We further focused our analysis on the 64 rural hospitals that closed and the 2,159 rural hospitals that were open during the years 2013 through 2017. For this analysis, we excluded hospitals that had missing data. We used ZIP Code tabulation areas (ZCTA) as our unit of analysis. ZCTAs are Census's generalized representations of U.S. Postal Service ZIP Codes. Service areas with closures represent the collection of 362 ZCTAs that were served by closed rural hospitals; service areas without closures represent the collection of 15,004 ZCTAs served only by rural hospitals that were open. We excluded ZCTAs with missing data.

According to Census, race and ethnicity are two separate and distinct concepts. Hispanics may report as any race.

Median percentages reported in this table may not be from the same ZCTA; as such, race and age subcategories will not sum to 100 percent.

Socioeconomic Characteristics

In addition, we examined certain socioeconomic characteristics of residents in service areas with and without rural hospital closures. Specifically, our analysis of Census and HHS data found that from 2013 through 2017,

- The median percentage of residents with a bachelor's degree or higher was 14.2 percent in service areas with closures and 16.5 percent in service areas without closures.
- The median percentage of residents who were unemployed was 6.5 percent in service areas with closures and 5.3 percent in service areas without closures.
- The median percentage of residents with no health insurance coverage was 12.7 percent in service areas with closures and 8.9 percent in service areas without closures.
- The median family income was $52,995 in service areas with closures and $58,562 in service areas without closures. Moreover, the median percentage of families with incomes below the poverty level was 13.3 percent in service areas with closures and 9.3 percent in service areas without closures (see table 13).

Table 13: Socioeconomic Characteristics among Residents in Service Areas with and without Rural Hospital Closures, 2013–2017

Socioeconomic characteristic	Service areas with closures	Service areas without closures
Bachelor's degree or higher (median percentage)[a]	14.2	16.5
Unemployed (median percentage)[b]	6.5	5.3
No health insurance coverage (median percentage)[c]	12.7	8.9
Family income (median dollars)[d]	$52,995	$58,562
Income below poverty level (median percentage)	13.3	9.3

Source: GAO analysis of data from the U.S. Census Bureau, Department of Health and Human Services, and North Carolina Rural Health Research Program (NC RHRP). | GAO-21-93

Notes: We focused our analysis on general acute care hospitals in the United States. We defined hospitals as rural according to data from the Federal Office of Rural Health Policy. We defined hospital closure as a cessation of inpatient services, the same definition used by NC RHRP.

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[a]Data were limited to residents 25 years and older.

[b]Data were limited to residents 16 years and older, in labor force, and civilians (that is, not in armed forces).

[c]Data were limited to noninstitutionalized civilian residents.

[d]Median family income represents income in the past 12 months, in 2017 inflation-adjusted dollars.

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

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