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Health Care Professional Workforce Composition before and after Rural Hospital Closure

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Purpose

The closure of rural hospitals (i.e. cessation of delivery of inpatient services) is an increasing source of concern to health policymakers. In addition to the loss of inpatient services, hospital closure may trigger changes in other community health care resources. This policy brief examines the composition of the local health care workforce before and after rural hospital closure to reveal any associations with discontinuation of inpatient services in rural communities.

Key Findings

- Following hospital closure, many rural communities (38.8 percent) saw a decrease in the number of primary care physicians (PCPs). But the majority of communities with a hospital closure (61.2 percent) saw an increase in the number of advanced practice providers (APPs, includes physician assistants and advanced nurse practitioners). In over half (54.5 percent) of the communities where the number of PCPs declined, the number of APPs increased.
- Over one-third (37.8 percent) of the communities where the closed hospital was converted to some other type of health care facility saw an increase in the number of PCPs, whereas only 14.6 percent of communities where the hospital building was completely closed saw an increase in the number of PCPs.
- In the majority of communities where the number of post-closure PCPs either stayed the same or increased, the number of APPs also increased (58.1 percent and 76.2 percent, respectively).

Introduction

Hospitals are often considered the central component of the health care system, particularly in rural areas.^{1,2} In addition to providing inpatient care, many rural hospitals also provide outpatient, rehabilitation, home health, skilled nursing services, obstetrical services, and others.^{3,4} Further, rural hospitals frequently provide a safety net function owing to the scarcity of other health care service resources.^{5,6} Finally, community hospitals are often seen as important drivers (both in terms of consumption and employment) in their local economies.^{7,8} They are also a “go to” entity when the community faces particular health challenges like the current COVID-19 pandemic. The key role of rural hospitals makes the increasing trend in closures since 2010 very troubling in context of meeting local health needs.^{1,9,10} As of December 2019, 120 rural hospitals are listed as having closed since 2010.¹²



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In some instances, following rural hospital closure there is outmigration of clinical personnel. This is particularly true where the local physicians were employed by the hospital or if the ability to admit patients to a local hospital was deemed an essential element of physician practice.¹³ McGrail et al. found that the lack of a hospital in the county (along with primary care physician supply and degree of county rurality) was a significant factor associated with community physician loss.¹⁴ Conversely, hospital closure may lead rural communities to consider alternative models of care (whether or not the physical plant is retained and repurposed), including free-standing emergency or urgent care centers, outpatient care centers, and skilled nursing facilities.^{9,13} Those models, and continuation of ambulatory care (e.g., ambulatory clinics, including Rural Health Clinics [RHCs] and Federally Qualified Health Centers [FQHCs]), may sustain—and possibly expand—availability of primary care and other necessary services in the absence of inpatient care. This brief examines the composition of the health care workforce before and after hospital closure to reveal any trends associated with closure.

Data and Methods

Hospital closure data were obtained from the North Carolina Rural Health Research Program (NCRHRP).¹² NCRHRP defines a rural hospital as “any short-term, general acute, non-federal hospital that (a) is not located in a metropolitan county OR (b) is located in a Rural Urban Commuting Area type 4 or higher OR (c) is a Critical Access Hospital.” They further specify that closure is defined “as the cessation in the provision of inpatient services.”¹² Data from rural hospital closures that occurred January 2010 through June 2018 were used, for a total of 85 communities with hospital closure. Ending the time frame in 2018 enabled us to include data for 15-18 months post closure. Hospitals were categorized as either complete closures or converted closures, based on whether the hospital facility was completely shut or repurposed as another type of health care facility.¹² National Provider Identifier (NPI) data were used to determine the number of providers (primary care physicians, specialty care physicians, and advanced practice providers) indicating their primary practice was located in a community (i.e. the named place – town, city – of the hospital) where the hospital closed.¹⁵ Quarterly NPI data from a period of 15-18 months prior to closure and 15-18 months following a closure from 2010-2018 were used to identify provider types and generate counts. The number of months is a function of when the hospital closed, that is, if it closed in the midst of an NPI data quarter, we would have five quarters after closure; if closure coincides with NPI quarters, 18 months.

Results

The change in the number of health care providers in rural communities where the hospital closed is shown in Figure 1 and Table 1. As explained in the methods section, the data are restricted to closures January 2010 – June 2018 to allow assessment of provider numbers up to 18 months post closure, yielding a sample of 85 communities. Many communities 15-18 months post-closure saw a decrease in the number of PCPs (33, 38.8 percent), with losses in PCP supply ranging from 4.3 percent to 60.0 percent. But at the same time, the majority of communities with a hospital closure saw an increase in the number of APPs (52, 61.2 percent). In slightly over half (18, 54.5 percent) of the communities where the number of PCPs declined, the number of APPs increased (Table 2)

The specialty provider (other than PCPs, as identified by the NPI classification) count decreased in roughly one-quarter (21, 24.7 percent) of the communities after a hospital closure, but over half of the communities saw no change (including the 22 communities with no specialty providers to begin with). In communities where the hospital was converted to some other type of health care facility, 37.8 percent saw an increase in the number of PCPs, whereas only 14.6 percent of communities with a complete closure saw an increase in the number of PCPs.

In communities where the number of post-closure PCPs either stayed the same or increased, the number of APPs also increased (58.1 percent and 76.2 percent, respectively). It is also worth noting that approximately one-fourth (24.2 percent) of the communities that lost PCPs also saw a decrease in the number of APPs, suggesting migration of both type of providers from the communities (findings not shown in tables). Interestingly, this behavior was more common in communities that experienced a converted closure (33.3 percent) than in communities that experienced a complete closure (16.7 percent).

Table 1. Change in provider counts in rural communities with closed hospitals, 2010 – 2018, from 15-18 months before closure to 15-18 months after closure

Provider Type	Change in Providers	All Closures (N = 85) ^c			Complete Closure ^a (N = 48) ^c			Converted Closure ^b (N = 37) ^c		
		N (pct)	Median		N (pct)	Median		N (pct)	Median	
			Before Close	After Close		Before Close	After Close		Before Close	After Close
Advanced Practice Providers (APPs)^d	Decreased	15 (17.6%)	5	3	8 (16.7%)	3.5	2.5	7 (18.9%)	8	5
	Remained the Same	15 (17.6%)	4		8 (16.7%)	4		7 (18.9%)	5	
	Increased	52 (61.2%)	6	8.5	30 (62.5%)	6.5	9.5	22 (59.5%)	4	6
	None pre/post	3 (3.5%)	---	---	2 (4.2%)	---	---	1 (2.7%)	---	---
Primary Care Physicians (PCPs)	Decreased	33 (38.8%)	7	5	18 (37.5%)	7	5	15 (40.5%)	5	4
	Remained the Same	30 (35.3%)	4		23 (47.9%)	4		7 (18.9%)	5	
	Increased	21 (24.7%)	8	9	7 (14.6%)	12	13	14 (37.8%)	8	9
	None pre/post	1 (1.2%)	---	---	0	---	---	1 (2.7%)	---	---
Specialty Physicians	Decreased	21 (24.7%)	8	6	11 (22.9%)	8	6	10 (27.0%)	10.5	8
	Remained the Same	25 (29.4%)	2		14 (29.2%)	2		11 (29.7%)	2	
	Increased	17 (20.0%)	7	9	9 (18.7%)	7	9	8 (21.6%)	6	7.5
	None pre/post	22 (25.9%)	---	---	14 (29.2%)	---	---	8 (21.6%)	---	---

Source: National Provider Identifier data, 2008-2019.⁶

^aComplete closures are those hospitals where the facility was not repurposed as another type of health care facility.

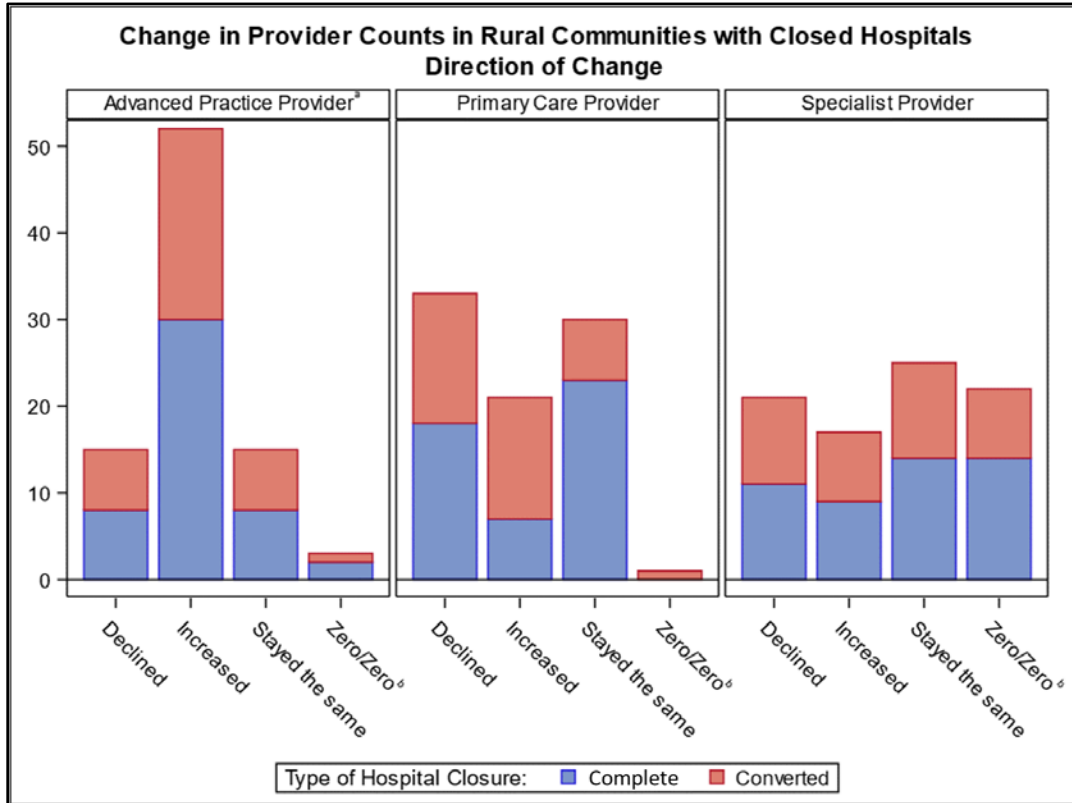
^bConverted closures are those hospitals where the facility was repurposed as another type of health care facility.

^cProvider type change counts do not sum to column n's as those communities with no providers to start with are not included in the table.

^dAdvanced practice providers includes both nurse practitioners and physician assistants.

Changes in the seven most common physician specialty types in communities where hospitals closed are shown in Table 3. The majority of communities had no specialty providers, except in emergency medicine, either before or after closure. Surgery, followed by emergency medicine, was the specialty type most likely to decrease in communities with a hospital closure. Communities seeing increases in the number of any specialty type were relatively rare.

Figure 1. Change in provider counts in rural communities with closed hospitals 2010 – 2018, from 18 months before closure to 18 months after closure



Source: National Provider Identifier data, 2008-2019.⁶

^a Advanced Practice Providers includes both nurse practitioners and physician assistants.

^b “Zero/Zero” are communities where there were none of the indicated providers either prior to or following hospital closure.

Table 2. Relationship between change in the number of primary care physicians and advanced practice providers in rural communities with closed hospitals from 18 months before closure to 18 months after closure

		Change in the Number of Primary Care Physicians N(pct)			
		<i>Decreased</i>	<i>Remained the Same^b</i>	<i>Increased</i>	<i>Total (row pct)</i>
Change in the Number of Advanced Practice Providers^a N(pct)	<i>Decreased</i>	8 (9.4%)	6 (7.1%)	1 (1.2%)	15 (17.6%)
	<i>Remained the Same^c</i>	7 (8.2%)	7 (8.2%)	4 (4.7%)	18 (21.2%)
	<i>Increased</i>	18 (21.2%)	18 (21.2%)	16 (18.8%)	52 (61.2%)
	<i>Total (col pct)</i>	33 (38.8%)	31 (36.5%)	21 (24.7%)	

Source: National Provider Identifier data, 2008-2019.⁶

^aAdvanced practice providers includes both nurse practitioners and physician assistants.

^bIncludes one community that had no primary care physicians prior to or following hospital closure.

^cIncludes three communities that had no advanced practice providers prior to or following hospital closure.

Table 3. Changes in specialist provider counts in communities with closed hospitals, 2010-2018

Specialty	Change in Providers	All Closures (N=85)				Complete Closure ^a (N=48)				Converted Closure ^b (N=37)			
		N	Pct.	Median		N	Pct.	Median		N	Pct.	Median	
				Before Close	After Close			Before Close	After Close			Before Close	After Close
Emergency Medicine	Decreased	12	14.1%	4	3	6	12.5%	3.5	2.5	6	16.2%	5	3
	Remained the same	31	36.5%	2		21	43.8%	1		10	27.0%	2	
	Increased	11	12.9%	4	5	4	8.3%	2	3	7	18.9%	4	5
	N/A ^c	31	36.5%			17	35.4%			14	37.8%		
Surgery	Decreased	13	15.3%	2	1	5	10.4%	2	1	8	21.6%	3	2
	Remained the same	19	22.4%	1		12	25.0%	1		7	18.9%	1	
	Increased	5	5.9%	2	3	3	6.3%	3	4	2	5.4%	1	2
	N/A ^c	48	56.5%			28	58.3%			20	54.1%		
Internal Medicine ^d	Decreased	6	7.1%	2	0.5	4	8.3%	2	0.5	2	5.4%	2	0.5
	Remained the same	11	12.9%	1		4	8.3%	1		7	18.9%	1	
	Increased	6	7.1%	3	6.5	3	6.3%	1	3	3	8.1%	16	19
	N/A ^c	62	72.9%			37	77.1%			25	67.6%		
Psychiatry & Neurology	Decreased	5	5.9%	9	7	3	6.2%	9	7	2	5.4%	5.5	4
	Remained the same	14	16.5%	1		7	14.6%	1		7	18.9%	1	
	Increased	11	12.9%	1	2	7	14.6%	0	2	4	10.8%	3.5	6.5
	N/A ^c	55	64.7%			31	64.6%			24	64.9%		
Radiology	Decreased	5	5.9%	3	2	3	6.2%	2	1	2	5.4%	3.5	2.5
	Remained the same	13	15.3%	1		8	16.7%	1		5	13.5%	1	
	Increased	4	4.7%	1.5	4.5	1	2.1%	2	4	3	8.1%	1	5
	N/A ^c	63	74.1%			36	75.0%			27	73.0%		
Anesthesiology	Decreased	3	3.5%	2	1	2	4.2%	1.5	0.5	1	2.7%	3	2
	Remained the same	9	10.6%	1		2	4.2%	2.5		7	18.9%	1	
	Increased	7	8.2%	6	7	4	8.3%	1	2	3	8.1%	8	10
	N/A ^c	66	77.7%			40	83.3%			26	70.3%		
Orthopedic Surgery	Decreased	3	3.5%	1	0	2	4.2%	2.5	1.5	1	2.7%	1	0
	Remained the same	16	18.8%	2		6	12.5%	1.5		10	27.0%	2.5	
	Increased	1	1.2%	2	3	0	0%	0	0	1	2.7%	2	3
	N/A ^c	65	76.5%			40	83.3%			25	67.6%		
Other specialty	Decreased	7	8.2%	4	3	1	2.1%	3	2	6	16.2%	4	3
	Remained the same	11	12.9%	1		7	14.6%	1		4	10.8%	1.5	
	Increased	4	4.7%	8	10	2	4.2%	6	7.5	2	5.4%	8.5	12.5
	N/A ^c	63	74.1%			38	79.2%			25	67.6%		

Source: National Provider Identifier data, 2008-2019.⁶

^a Complete closures are hospitals where the facility was not repurposed as another type of health care facility.

^b Converted closures are hospitals where the facility was repurposed as another type of health care facility.

^c N/A: specialty was not present in the community before or after closure.

^d Internal Medicine specialty providers, do not include general internal medicine providers.

Discussion

Prior work has shown that poor economic conditions, outdated and aged infrastructure, decreasing occupancy rates, weak markets, and health care professional recruitment and retention challenges are associated with rural hospital closures.^{13,16} The relationship between hospital closure and the presence of health care providers in the community is complex. While this paper focuses on differences after hospital closure, further investigation should include longer trend data to examine two possibilities (not mutually exclusive): that the number of providers was trending downward, contributing to hospital closure and/or that the loss of professionals accelerated after closure. Our data show that in some communities the number of providers (of any type) increased after closure. The numbers, though, are quite small, both the number of places where this occurs and the number of providers involved. These may be places where closing the hospital (recall the definition of ceasing inpatient services) was part of a strategic shift to a different means of delivering services that could include specialty providers practicing at an ambulatory clinic in that community and seeing patients in a hospital in a different community. Understanding the realm of possibilities requires further research including case studies.

This brief focuses only on what transpires after closure, meeting our objective of assessing one measure of access to care. Our results show that 15–18 months post-closure, many communities with a hospital closure (38.8 percent) saw a decline in the number of PCPs, but that the number of APPs increased in most communities (61.2 percent). It is not clear from our data whether the increase in the number of APPs in communities post-closure is the result of professional substitution (e.g., APPs serving in positions previously occupied by PCPs), expansion of primary care services in the community, conversion of billing status of APPs after the PCPs left (conceivable that they continued billing under the PCP's number and converted later; we know most conversions to direct billing among physician assistants and nurse practitioners occurred in the same years of this study¹⁸), or expansion of the roles filled by APPs, potentially linked to changes in state regulations of scope of practice.

This study is not without limitations, most of which are related to the use of NPI data to track providers. The information in the NPI is self-reported and CMS does very little to verify the reported information. Although providers are required to update their information within 30 days of a change in their required data, the degree of compliance with this rule is unknown.¹⁷ Further, early releases of the NPI data listed only a provider's primary practice location (additional practice location data was first released in January 2019). As a result, more providers may be practicing in a given rural community than are identifiable in our data. Finally, some providers are not listed in the NPI data, including APPs that have never billed insurers for health care services (e.g., they have billed for service through their supervising physician). This final concern about the limitations imposed by utilization of the NPI data is heightened by the general growth in the number of APPs, particularly in rural areas. Despite its limitations, NPI suits our purposes better than alternatives such as licensing data which is not as accurate in locating the actual practice site.¹⁹ Further, NPI data provides "reasonably accurate, up-to-date address information" for researchers, and performs well in comparison to the American Medical Association Master File.²⁰

Closure of a rural hospital can have a dramatic effect on a community's access to health care services and its economic viability, whether the hospital is completely closed or converted. A major concern for rural communities is the availability of health care services after acute care facilities close. Data presented here suggest a continuing presence of primary care service providers in a majority of communities, with some possible shift from physician-based care to care provided by APPs. Future analysis should continue this effort to understand the effects of changes in hospital services on the mix of health care services in rural communities. More detailed examination should include understanding changes in referral patterns by PCPs in those communities, connection of local providers with larger systems of care (which may explain continued presence of some non-primary care specialists), and relationship of provider composition to other characteristics of the community (e.g., population demographics, employment rates and other economic indicators, or payer mix). Data presented in this paper suggest it is not possible to paint all rural places that lose hospital inpatient services (and those on the brink of doing so) with the same brush. This is not to minimize the consequences of hospital closure, which has been well documented to impact both access to services and broader community economic issues. Rather, the findings in this paper suggest a nuanced understanding of consequences that can inform public policy responses and health system decisions that seek to maintain appropriate access to care based on each community's needs.

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