NC RHRP

Findings Brief
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Association between Rural Hospital Service Changes and Community Demographics

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BACKGROUND AND PURPOSE

Hospitals provide a multitude of important health care services. Particularly in rural communities, the loss of local services can reduce access to care given the limited availability of alternative providers.[1, 2] Recent research by Knocke et al.[3] investigated changes in services provided by rural hospitals and found that trends in availability differed by service type. For instance, the study authors found that the availability of skilled nursing, obstetrics, labor and delivery, and home health services declined between 2009 and 2017, whereas the availability of orthopedic services, oncology services, hospital-based outpatient services, emergency psychiatric services, and chemotherapy services increased over the same time period. The purpose of this companion brief is to extend the work by Knocke et al. and investigate possible differences in service availability by local demographics. As a motivating example, research by Thomas et al.[4] showed that rural communities with a greater percentage of Black or Hispanic residents were more likely to experience a local hospital closure than other rural communities. Black and Hispanic populations are two of several priority populations identified by the Agency for Healthcare Research and Quality (AHRQ).[5] This brief further investigated the association between the proportion of a rural community belonging to a priority population and local hospital service changes.

METHODS

We first identified hospitals in non-metro counties using the definition provided by the Office of Management and Budget.[6] Next, we identified hospital service availability for the years 2011 and 2017 by using the American Hospital Association (AHA) Annual Survey Database™.[7] We identified services of interest using criteria from Knocke et al.[3] on changes in rural hospital service availability. Briefly, a service had to be (1) offered by most hospitals during the study period and (2) generally only offered by hospital-based practitioners. Based on these criteria, we analyzed the following eight services for this research: chemotherapy, home health, obstetrics, oncology, hospital-based outpatient care, orthopedics, emergency psychiatric services, and skilled nursing.

For each service of interest, we identified all sampled hospitals that responded to the respective AHA Annual Survey questions on service availability for both 2011 and 2017. We then calculated the number of hospitals that indicated the service was available in 2011 as well as the number of hospitals that indicated the service was available in 2017. We stratified results by demographics of the county in which the hospital was located using data provided in the Area Health Resource File.[8] Specifically, we calculated the median county percent for four AHRQ-identified priority populations[5] (i.e., median county

KEY FINDINGS

- From 2011-2017, the availability of obstetric services and skilled nursing services *decreased* among hospitals in non-metro counties with a greater percentage of residents belonging to priority populations, as defined by the Agency for Healthcare Research and Quality.
- From 2011-2017, the availability of oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services *increased* among hospitals in non-metro counties with a greater percentage of residents belonging to priority populations.
- Similar trends in service availability were observed among hospitals in non-metro counties with a lower percentage of residents belonging to priority populations.

percent Hispanic/Latino population, percent non-Hispanic Black population, percent population aged 65 years or older, and percent population in poverty) and then stratified hospitals based on whether the hospital's county was above or below the median percent.[9] Hospitals in counties at the median percent were included in the "above" category (results were generally similar when counties at the median were included in the "below" category instead). Demographics were based on values from the year 2010 to mitigate bias due to reverse causality (i.e., shifts in county demographics as a result of service changes). We used bootstrap procedures[10] and a significance level of $\alpha = 0.10$ to assess whether differences in service changes between hospitals in the "above" and "below" categories were statistically significant.

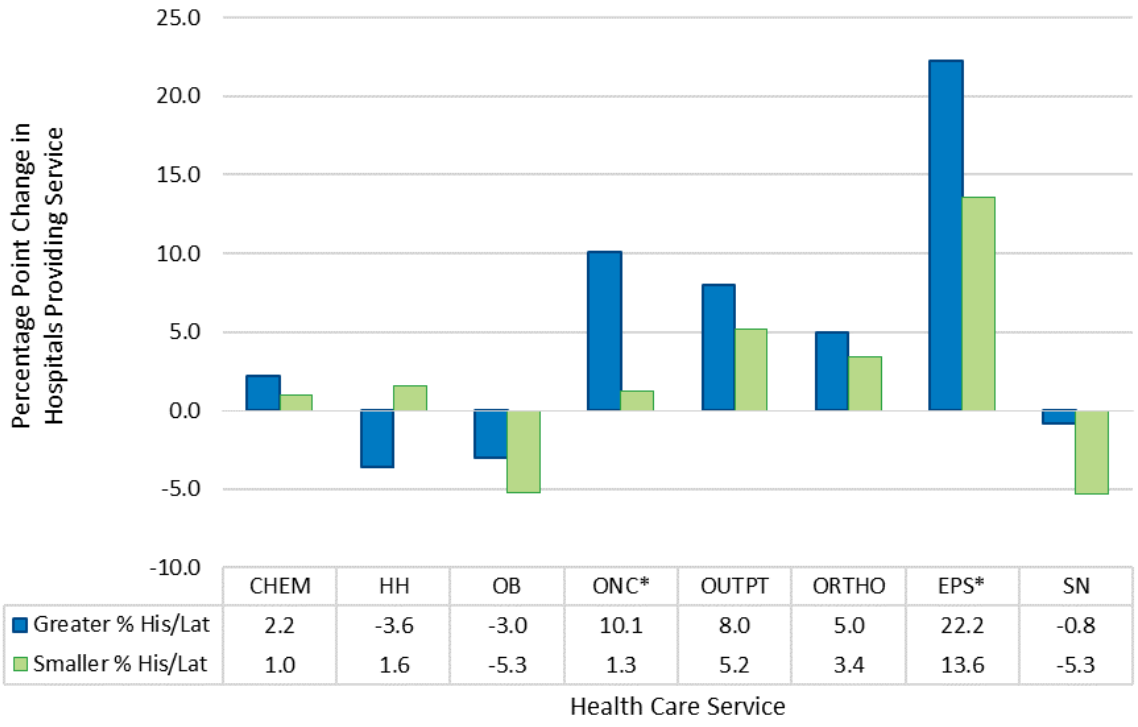
In addition to the stratified analyses, we calculated aggregate changes in service availability using our full sample of rural hospitals. This aggregated analysis provided important context for the stratified results and allowed us to directly compare our findings to those from previous research.[3]

RESULTS

Service Changes by Percent of Population that Is Hispanic/Latino

Figure 1 shows changes in hospital-based service availability from 2011-2017, comparing hospitals in non-metro counties with a greater versus smaller percentage of the population that is Hispanic/Latino. From 2011-2017, hospitals in non-metro counties with a greater Hispanic/Latino percentage experienced a net *decrease* in the availability of home health services, obstetric services, and skilled nursing services and a net *increase* in the availability of chemotherapy services, oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services. Results were generally similar for counties with a smaller Hispanic/Latino percentage (Figure 1), although hospitals in these counties experienced significantly smaller increases in the availability of oncology and emergency psychiatric services. We provide complete results for the analysis of hospitals and local Hispanic/Latino demographics in Appendix Table A1.

Figure 1. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Greater vs. Smaller Percentage of the Population that Is Hispanic/Latino



	CHEM	HH	OB	ONC*	OUTPT	ORTHO	EPS*	SN
Greater % His/Lat	2.2	-3.6	-3.0	10.1	8.0	5.0	22.2	-0.8
Smaller % His/Lat	1.0	1.6	-5.3	1.3	5.2	3.4	13.6	-5.3

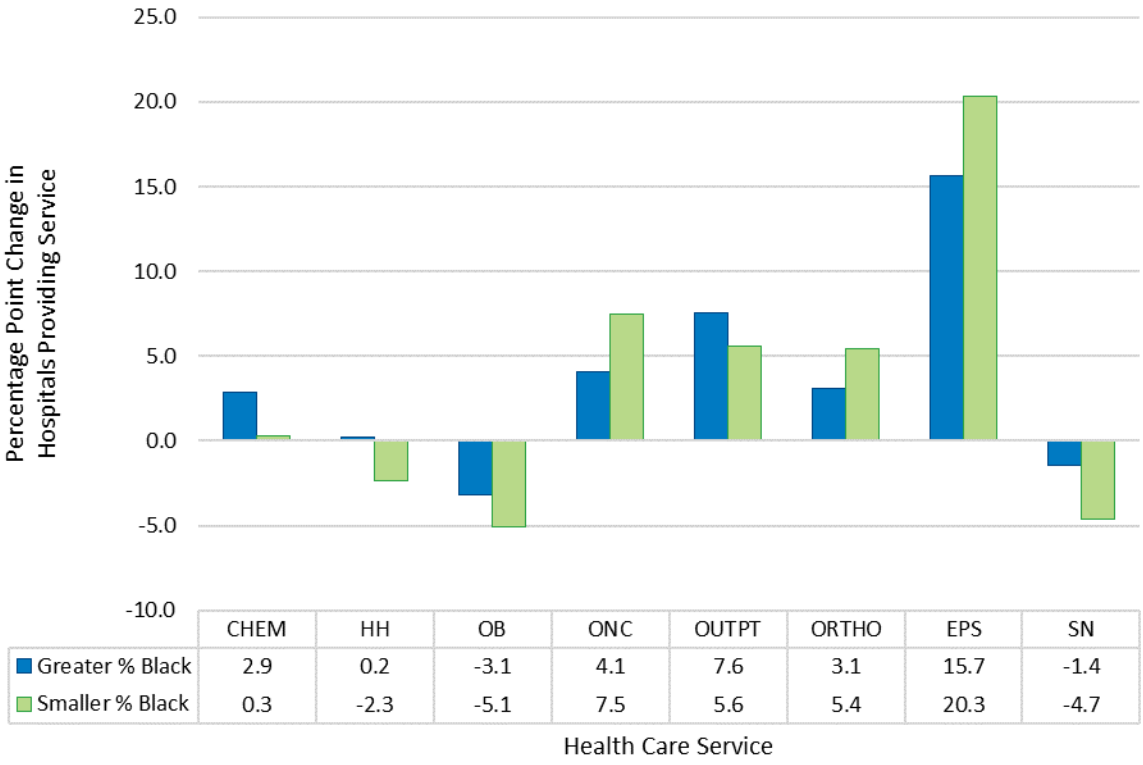
Notes: Hospitals included in Figure 1 are stratified based on whether the hospital's county was above or below the median county percent Hispanic/Latino population (i.e., "Greater % His/Lat" vs. "Smaller % His/Lat," respectively). Abbreviations: CHEM = chemotherapy; HH = home health; OB = obstetrics; ONC = oncology; OUTPT = hospital-based outpatient; ORTHO = orthopedics; EPS = emergency psychiatric services; SN = skilled nursing.

*Difference between "Greater % His/Lat" and "Smaller % His/Lat" categories is statistically significant at $\alpha = 0.10$.

Service Changes by Percent of Population that Is Non-Hispanic Black

Figure 2 shows changes in hospital-based service availability from 2011-2017, comparing hospitals in non-metro counties with a greater versus smaller percentage of the population that is non-Hispanic Black. From 2011-2017, hospitals in non-metro counties with a greater non-Hispanic Black percentage experienced a net decrease in the availability of obstetric services and skilled nursing services and a net increase in the availability of chemotherapy services, home health services, oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services from 2011-2017. Results were generally similar (i.e., not significantly different) for hospitals in counties with a smaller non-Hispanic Black percentage (Figure 2). We provide complete results in Appendix Table A2.

Figure 2. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Greater vs. Smaller Percentage of the Population that Is Non-Hispanic Black



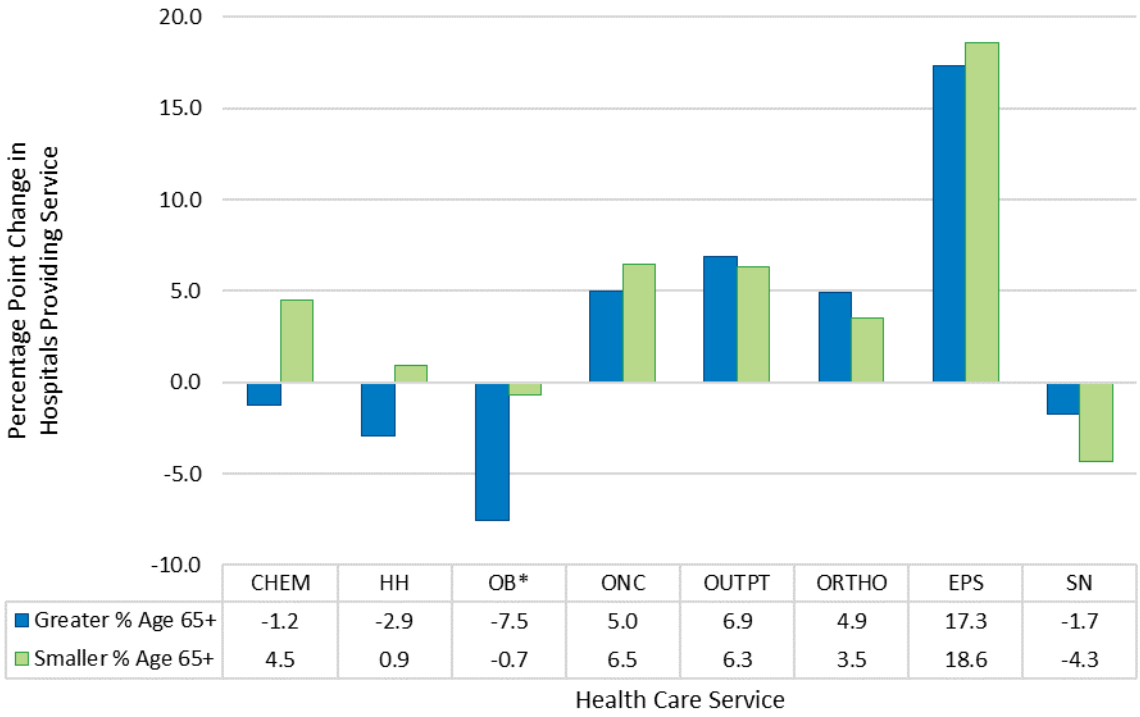
	CHEM	HH	OB	ONC	OUTPT	ORTHO	EPS	SN
Greater % Black	2.9	0.2	-3.1	4.1	7.6	3.1	15.7	-1.4
Smaller % Black	0.3	-2.3	-5.1	7.5	5.6	5.4	20.3	-4.7

Notes: Hospitals included in Figure 2 are stratified based on whether the hospital's county was above or below the median county percent non-Hispanic Black population (i.e., "Greater % Black" vs. "Smaller % Black," respectively). Abbreviations: CHEM = chemotherapy; HH = home health; OB = obstetrics; ONC = oncology; OUTPT = hospital-based outpatient; ORTHO = orthopedics; EPS = emergency psychiatric services; SN = skilled nursing.

Service Changes by Percent of Population Aged 65 Years or Older

Figure 3 shows changes in hospital-based service availability from 2011-2017, comparing hospitals in non-metro counties with a greater versus smaller percentage of the population that is aged 65 years or older. From 2011-2017, hospitals in non-metro counties with a greater percentage of the population aged 65 years or older experienced a net *decrease* in the availability of chemotherapy services, home health services, obstetric services, and skilled nursing services and a net *increase* in the availability of oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services. Results were generally similar for counties with a smaller percentage of the population aged 65 years or older (Figure 3), although hospitals in these counties experienced significantly smaller decreases in the availability of obstetric services. In other words, counties with a greater percentage of the population at or over age 65 were significantly more likely to see a decline in the availability of obstetric services. We provide complete results in Appendix Table A3.

Figure 3. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Greater vs. Smaller Percentage of the Population that Is Aged 65 Years or Older



	CHEM	HH	OB*	ONC	OUTPT	ORTHO	EPS	SN
Greater % Age 65+	-1.2	-2.9	-7.5	5.0	6.9	4.9	17.3	-1.7
Smaller % Age 65+	4.5	0.9	-0.7	6.5	6.3	3.5	18.6	-4.3

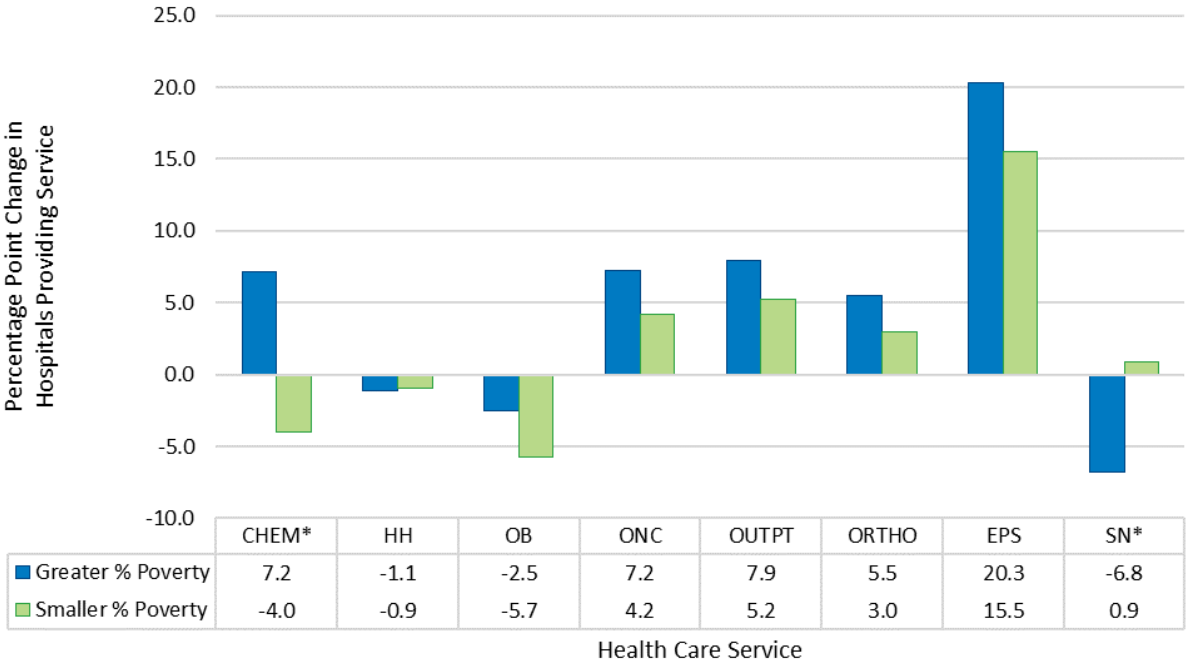
Notes: Hospitals included in Figure 3 are stratified based on whether the hospital's county was above or below the median county percent population aged 65 years or older (i.e., "Greater % Age 65+" vs. "Smaller % Age 65+," respectively). Abbreviations: CHEM = chemotherapy; HH = home health; OB = obstetrics; ONC = oncology; OUTPT = hospital-based outpatient; ORTHO = orthopedics; EPS = emergency psychiatric services; SN = skilled nursing.

*Difference between "Greater % Age 65+" and "Smaller % Age 65+" categories is statistically significant at $\alpha = 0.10$.

Service Changes by Percent of Population in Poverty

Figure 4 shows changes in hospital-based service availability from 2011-2017, comparing hospitals in non-metro counties with a greater versus smaller percentage of the population that is in poverty. From 2011-2017, hospitals in non-metro counties with a greater percentage of the population in poverty experienced a net *decrease* in the availability of home health services, obstetric services, and skilled nursing services and a net *increase* in the availability of chemotherapy services, oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services. Results were generally similar for counties with a smaller poverty percentage (Figure 4), although hospitals in these counties experienced significantly different changes in the availability of chemotherapy and skilled nursing services (hospitals in counties with a smaller poverty percentage experienced a net decrease in the availability of chemotherapy services and a net increase in the availability of skilled nursing services). We provide complete results in Appendix Table A4.

Figure 4. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Greater vs. Smaller Percentage of the Population in Poverty



	CHEM*	HH	OB	ONC	OUTPT	ORTHO	EPS	SN*
Greater % Poverty	7.2	-1.1	-2.5	7.2	7.9	5.5	20.3	-6.8
Smaller % Poverty	-4.0	-0.9	-5.7	4.2	5.2	3.0	15.5	0.9

Notes: Hospitals included in Figure 4 are stratified based on whether the hospital's county was above or below the median county percent population in poverty (i.e., "Greater % Poverty" vs. "Smaller % Poverty," respectively). Abbreviations: CHEM = chemotherapy; HH = home health; OB = obstetrics; ONC = oncology; OUTPT = hospital-based outpatient; ORTHO = orthopedics; EPS = emergency psychiatric services; SN = skilled nursing.

*Difference between "Greater % Poverty" and "Smaller % Poverty" categories is statistically significant at $\alpha = 0.10$.

Aggregate Changes in Service Availability

Table 1 shows aggregate changes in hospital-based service availability from 2011-2017, calculated using our full sample of rural hospitals. From 2011-2017, hospitals in non-metro counties generally experienced a net *decrease* in the availability of home health services, obstetric services, and skilled nursing services and a net *increase* in the availability of chemotherapy services, oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services.

Table 1. Change in Rural Hospital Service Availability from 2011-2017

Service	2011 # [a]	2011 %	2017 # [a]	2017 %	Net Percent Point Change	N [b]
Chemotherapy	658	81.9%	671	83.6%	1.7	803
Home Health	729	82.7%	720	81.7%	-1.0	881
Obstetrics	809	92.4%	773	88.2%	-4.2	876
Oncology	657	81.7%	703	87.4%	5.7	804
Hospital-based Outpatient Care	956	86.3%	1,029	92.9%	6.6	1,108
Orthopedics	896	87.8%	939	92.0%	4.2	1,021
Emergency Psychiatric Services	391	62.7%	503	80.6%	17.9	624
Skilled Nursing	508	72.7%	487	69.7%	-3.0	699

[a] Indicates the number of hospitals that provided the given service.

[b] We required hospitals in our analysis to report the availability of health care services in both the 2011 and 2017 AHA Annual Survey. Given differences in reporting rates by service, the sample size (N) varies by service.

DISCUSSION

The purpose of this brief was to investigate the association between the proportion of a rural community belonging to an AHRQ-identified priority population[5] and local hospital service changes. Our results suggest that recent trends in service availability are often similar when comparing hospitals in non-metro counties with larger versus smaller priority populations. In aggregate, from 2011-2017, hospitals in non-metro counties generally experienced a net *decrease* in the availability of obstetric services and skilled nursing services and a net *increase* in the availability of oncology services, hospital-based outpatient services, orthopedic services, and emergency psychiatric services. Aggregate changes in the availability of home health and chemotherapy were generally smaller in magnitude. These aggregate results are consistent with previous work on rural hospital-based service availability.[3]

Research shows that hospital-based service availability is a key issue affecting rural communities.[11] For instance, the percentage of U.S. non-metro counties that offer hospital maternity services has decreased due to hospital and maternity unit service contraction and hospital closures, potentially reducing rural access to maternity care.[12] Furthermore, 17 percent of non-core counties lack behavioral health providers contrasted with three percent of metropolitan counties.[13] In a recent survey of Rural Health Clinic staff across 27 states, respondents attributed lack of specialty care access to multiple factors, including a shortage of providers in rural areas, limited appointment availability, distance, transportation, and insurance issues.[14] These barriers for older Americans and people with disabilities are frequently compounded by a lack of physical accessibility at the offices of many health care providers and a lack of access to medical diagnostic equipment.[15] In addition, low population densities in rural areas are often incapable of generating sufficient patient demand to support necessary provider types,[16] resulting in continued financial vulnerability for health care institutions.

Future studies should continue to explore changes in rural access to care, including changes affecting additional AHRQ-identified priority populations.[5] Future research can further complement our findings by analyzing the relationship between service changes and subsequent effects on rural health, and, in particular, possible policy solutions to mitigate observed declines in the availability of home health, obstetrics, and skilled nursing services.

APPENDIX

Table A1. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Larger vs. Smaller Hispanic/Latino Population (Complete Results)

Service	Above (or at) Median: Population Percent Hispanic/Latino						Below Median: Population Percent Hispanic/Latino					
	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]
Chemotherapy	331	81.3%	340	83.5%	2.2	407	327	82.6%	331	83.6%	1.0	396
Home Health	372	83.4%	356	79.8%	-3.6	446	357	82.1%	364	83.7%	1.6	435
Obstetrics	406	92.5%	393	89.5%	-3.0	439	403	92.2%	380	87.0%	-5.3	437
Oncology*	321	79.1%	362	89.2%	10.1	406	336	84.4%	341	85.7%	1.3	398
Hospital-based Outpatient Care	478	84.6%	523	92.6%	8.0	565	478	88.0%	506	93.2%	5.2	543
Orthopedics	456	87.9%	482	92.9%	5.0	519	440	87.6%	457	91.0%	3.4	502
Emergency Psychiatric Services*	181	57.5%	251	79.7%	22.2	315	210	68.0%	252	81.6%	13.6	309
Skilled Nursing	242	67.6%	239	66.8%	-0.8	358	266	78.0%	248	72.7%	-5.3	341

Notes: Hospitals included in Table A1 are stratified based on whether the hospital's county was above or below the median county percent Hispanic/Latino population.

[a] Indicates the number of hospitals that provided the given service.

[b] We required hospitals in our analysis to report the availability of health care services in both the 2011 and 2017 AHA Annual Survey. Given differences in reporting rates by service, the sample size (N) varies by service.

*Difference in "Net Pct. Point Change" between "Above" and "Below" median categories is statistically significant at $\alpha = 0.10$.

Table A2. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Larger vs. Smaller Non-Hispanic Black Population (Complete Results)

Service	Above (or at) Median: Population Percent Non-Hispanic Black						Below Median: Population Percent Non-Hispanic Black					
	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]
Chemotherapy	347	82.4%	359	85.3%	2.9	421	311	81.4%	312	81.7%	0.3	382
Home Health	373	82.5%	374	82.7%	0.2	452	356	83.0%	346	80.7%	-2.3	429
Obstetrics	418	93.9%	404	90.8%	-3.1	445	391	90.7%	369	85.6%	-5.1	431
Oncology	344	82.9%	361	87.0%	4.1	415	313	80.5%	342	87.9%	7.5	389
Hospital-based Outpatient Care	471	84.7%	513	92.3%	7.6	556	485	87.9%	516	93.5%	5.6	552
Orthopedics	487	89.7%	504	92.8%	3.1	543	409	85.6%	435	91.0%	5.4	478
Emergency Psychiatric Services	208	65.2%	258	80.9%	15.7	319	183	60.0%	245	80.3%	20.3	305
Skilled Nursing	241	67.9%	236	66.5%	-1.4	355	267	77.6%	251	73.0%	-4.7	344

Notes: Hospitals included in Table A2 are stratified based on whether the hospital's county was above or below the median county percent non-Hispanic Black population.

[a] Indicates the number of hospitals that provided the given service.

[b] We required hospitals in our analysis to report the availability of health care services in both the 2011 and 2017 AHA Annual Survey. Given differences in reporting rates by service, the sample size (N) varies by service.

Table A3. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Larger vs. Smaller Population Aged 65 Years or Older (Complete Results)

Service	Above (or at) Median: Population Percent Aged 65 Years or Older						Below Median: Population Percent Aged 65 Years or Older					
	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]	2011 #	2011 %	2017 #	2017 %	Net % Point Change	N[b]
Chemotherapy	334	83.1%	329	81.8%	-1.2	402	324	80.8%	342	85.3%	4.5	401
Home Health	371	84.1%	358	81.2%	-2.9	441	358	81.4%	362	82.3%	0.9	440
Obstetrics*	396	90.4%	363	82.9%	-7.5	438	413	94.3%	410	93.6%	-0.7	438
Oncology	331	82.3%	351	87.3%	5.0	402	326	81.1%	352	87.6%	6.5	402
Hospital-based Outpatient Care	481	86.8%	519	93.7%	6.9	554	475	85.7%	510	92.1%	6.3	554
Orthopedics	443	86.7%	468	91.6%	4.9	511	453	88.8%	471	92.4%	3.5	510
Emergency Psychiatric Services	198	63.5%	252	80.8%	17.3	312	193	61.9%	251	80.4%	18.6	312
Skilled Nursing	263	75.1%	257	73.4%	-1.7	350	245	70.2%	230	65.9%	-4.3	349

Notes: : Hospitals included in Table A3 are stratified based on whether the hospital's county was above or below the median county percent population aged 65 years or older.

[a] Indicates the number of hospitals that provided the given service.

[b] We required hospitals in our analysis to report the availability of health care services in both the 2011 and 2017 AHA Annual Survey. Given differences in reporting rates by service, the sample size (N) varies by service.

*Difference in "Net Pct. Point Change" between "Above" and "Below" median categories is statistically significant at $\alpha = 0.10$.

Table A4. Change in Health Care Service Availability from 2011-2017, Comparing Hospitals in Non-Metro Counties with a Larger vs. Smaller Population in Poverty (Complete Results)

Service	Above (or at) Median: Population Percent in Poverty						Below Median: Population Percent in Poverty					
	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]	2011 # [a]	2011 %	2017 # [a]	2017 %	Net % Point Change	N[b]
Chemotherapy*	320	79.0%	349	86.2%	7.2	405	338	84.9%	322	80.9%	-4.0	398
Home Health	364	82.4%	359	81.2%	-1.1	442	365	83.1%	361	82.2%	-0.9	439
Obstetrics	405	92.5%	394	90.0%	-2.5	438	404	92.2%	379	86.5%	-5.7	438
Oncology	313	77.9%	342	85.1%	7.2	402	344	85.6%	361	89.8%	4.2	402
Hospital-based Outpatient Care	460	83.0%	504	91.0%	7.9	554	496	89.5%	525	94.8%	5.2	554
Orthopedics	444	86.5%	472	92.0%	5.5	513	452	89.0%	467	91.9%	3.0	508
Emergency Psychiatric Services	191	60.6%	255	81.0%	20.3	315	200	64.7%	248	80.3%	15.5	309
Skilled Nursing*	253	71.5%	229	64.7%	-6.8	354	255	73.9%	258	74.8%	0.9	345

Notes: : Hospitals included in Table A4 are stratified based on whether the hospital's county was above or below the median county percent population in poverty.

[a] Indicates the number of hospitals that provided the given service.

[b] We required hospitals in our analysis to report the availability of health care services in both the 2011 and 2017 AHA Annual Survey. Given differences in reporting rates by service, the sample size (N) varies by service.

*Difference in "Net Pct. Point Change" between "Above" and "Below" median categories is statistically significant at $\alpha = 0.10$.

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