UTILIZATION OF INPATIENT AND EMERGENCY DEPARTMENT CARE FOLLOWING MEDICAID EXPANSION: A COMPARISON BETWEEN SAFETY-NET AND NON-SAFETY-NET HOSPITALS

ABSTRACT

Background

Medicaid expansion has shifted hospital payer mix in ways that may affect safety-net hospitals (SNHs) and non-SNHs differently.

Objective

To examine the impact of Medicaid expansion on changes in inpatient stays and emergency department (ED) visits for SNHs and non-SNHs, by expected payer.

Research Design

We used a difference-in-differences (DID) Poisson model to assess whether the pre-post Medicaid expansion (2011–2013 vs. 2014–2016) percent change in inpatient stay and ED visit volume differed between hospitals in expansion and nonexpansion states, separately for SNHs and non-SNHs.

Subjects

Nonmaternal stays and visits for adults aged 19–64 years.

Measures

We defined SNHs as those in the highest quartile within each state in terms of their percentage of Medicaid plus self-pay/no charge inpatient stays during the pre-expansion period.

Results

In expansion states, Medicaid inpatient stays increased by a smaller percentage at SNHs than at non-SNHs, and this disparity accelerated between 2014 (24.2%, P=0.005, vs. 41.1%, P<0.001) and 2016 (22.6%, P=0.065, vs. 52.4%, P<0.001). Although Medicaid expansion was associated with fewer ED visits billed to self-pay/no charge initially for both SNHs and non-SNHs (–20.5%, P=0.004, and –24.6%, P<0.001), by 2016 this effect was no longer statistically significant for SNHs (–24.2%, P=0.23, vs. –43.0%, P<0.001).

Conclusions

Medicaid patients became less concentrated in SNHs after the expansion. Nevertheless, SNHs continued to shoulder a disproportionate amount of ED care for uninsured patients. These results suggest that, going forward, SNHs may play an even more central role in serving individuals who remain uninsured.

BACKGROUND

Starting in January 2014, many states opted to expand Medicaid under the Affordable Care Act (ACA) to cover individuals earning up to 138% of the Federal Poverty Level (FPL). Around the same time, health insurance marketplaces were established to purchase private insurance. The individual mandate required that most Americans have basic health insurance, and a fine for those remaining uninsured was instituted through 2018. In expansion states, Medicaid enrollment increased and there was limited crowd-out of private insurance as low-income patients who previously did not qualify for Medicaid shifted from private to public insurance.[1,2] In both expansion and nonexpansion states, marketplace enrollment and enrollment in employer-sponsored private insurance plans increased and the number of uninsured individuals decreased.[2–5] A woodwork effect associated with increased publicity surrounding the ACA also increased Medicaid enrollment among previously uninsured patients who were already eligible for Medicaid.[6]

Medicaid expansion, crowd-out, marketplace, and woodwork effects have wide-ranging implications for hospitals, but changes in utilization by payer across safety-net hospitals (SNHs) and non-SNHs are not well understood. In view of newly eligible Medicaid patients, it is unclear to what extent SNHs will continue to shoulder a disproportionate amount of their care. For both SNHs and non-SNHs, the increase in Medicaid inpatient stays following Medicaid expansion[7] could have resulted from shifts in insurance status among existing patients, utilization by new patients who were not previously users of hospital care, and existing patients switching hospitals.[8] Location is a strong determinant of a patient's hospital choice.[9] Previously ineligible individuals now enrolled in Medicaid have higher incomes and are healthier than existing beneficiaries—with lower rates of asthma, diabetes, and obesity—and may be more likely to live near or prefer non-SNHs.[10] Non-SNHs may engage in tactics to attract newly eligible Medicaid patients, focusing on those who are healthier with less complex and less costly health care needs.[11]

Eligibility awareness and affordability remain concerns for millions of individuals who still lack insurance—especially for those in nonexpansion states with incomes below the FPL who do not qualify for Medicaid or marketplace subsidies—and for individuals who have private insurance but still have high out-of-pocket expenses.[12–14] Uninsured and underinsured individuals may be more likely to use SNH services than non-SNH services, which may be less costly, and to use emergency department (ED) services rather than primary care.[15] Safety-net ED directors report that despite an increase in Medicaid coverage among their patients, uninsured rates remain high.[16] Thus, remaining uninsured patients may be more concentrated at SNHs than at non-SNHs. Additionally, the extent to which new privately insured patients use SNH rather than non-SNH services remains to be seen. High deductibles and high levels of patient cost sharing in most plans purchased on the exchange may cause individuals to forgo care.[17] More bad debts may make these patients less desirable to non-SNHs.[17]

With respect to total utilization, research has shown that expanding health insurance coverage increases utilization of acute hospital care.[18] Unaddressed health issues may increase ED use, but this increase may be temporary as unmet health care needs are resolved and as patients connect with primary care.[19, 20] Increased demand could put additional stress on already-strained SNH systems, causing overcrowding and affecting quality of care.

Understanding the extent to which Medicaid expansion, separate from other provisions under the ACA, shifted utilization by Medicaid, uninsured, and privately insured patients at SNHs can provide insight into how future health care reforms might affect these hospitals. Monitoring these changes is important because payer mix affects hospital financing, especially for SNHs that

have narrow operating margins[21,22] and rely heavily on revenue from subsidies to offset Medicaid shortfalls and uncompensated care.[23] The expansion of insurance coverage under the ACA has resulted in substantial declines in uncompensated care,[7] likely bolstering the financial position of SNHs. However, SNHs may face ongoing challenges such as greater competition for new Medicaid patients,[24] cuts to Disproportionate Share Hospital payments that subsidize Medicaid shortfalls and uncompensated care,[25] payment penalties under value-based purchasing initiatives, and uncertainties regarding future health care policies.[26] The objective of this study was to examine the association between Medicaid expansion and utilization of inpatient and ED care at SNHs and non-SNHs by payer.

METHODS

Study Population

We extracted data from the 2011–2016 Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) for 11 expansion states (494 hospitals) and 9 nonexpansion states (470 hospitals). Data also were extracted from the State Emergency Department Databases (SEDD) for 7 expansion states (421 hospitals) and 6 nonexpansion states (296 hospitals) (see Appendix).[27] The SID contain inpatient stays, including those originating from the ED, whereas the SEDD contain treat-and-release ED visits.

We included nonfederal, general acute care hospitals in metropolitan statistical areas (MSAs) with 1 million or more residents. Hospitals were excluded that had missing data in any year, had fewer than 25 inpatient beds, or were in an MSA without at least 1 SNH and at least 1 non-SNH. We excluded hospitals in rural and smaller metropolitan areas because they often have (1) no competitors, (2) variability in utilization trends from quarter to quarter, and (3) specific challenges related to staffing and funding, warranting separate examination in future studies.

SNH Definition

To define SNHs, we used SID data from the 2011–2013 pre-expansion period to measure hospital Medicaid/self-pay/no charge caseload. Our definition is consistent with the Institute of Medicine definition and prior literature.[8,22,28] Using primary, secondary, and tertiary expected payer, we created mutually exclusive payer categories for Medicare, Medicaid, private insurance, self-pay/no charge, and all other insurance types, assigning precedence to payers in this order. We recategorized certain codes for other payer types (e.g., indigent care programs) as uninsured.[29] Next, we ranked hospitals by percentage of combined Medicaid plus self-pay/no charge inpatient stays among all stays at the hospital over the 3-year period, with SNHs defined as those in the highest quartile within each state.

Outcomes

We examined the volume of inpatient stays and ED visits by payer in each quarter from 2011 through 2016 for populations likely to be affected by the insurance coverage expansion: 19–64-year-old adults who had an expected payer of self-pay/no charge, Medicaid, or private insurance, excluding maternity stays and visits. We examined inpatient and ED volumes for each payer separately to study the impact of the ACA expansion on insurance transition effect sizes. We also examined encounter volumes for each of these patient populations in the aggregate to study how ACA-induced insurance transitions affected net utilization.

Analytic Approach

Descriptive Analysis

First, we analyzed average quarterly inpatient and ED volumes by safety-net and Medicaid expansion status. We computed projected postexpansion trends by quarter by extrapolating the (geometric) average growth rate over the baseline period into 2014, 2015, and 2016. The observed 2014–2016 trends are discussed in terms of being above trend, below trend, or on trend, compared with the projected trend.

The degree to which decreases in self-pay/no charge inpatient stays and ED visits were offset by increases in stays and visits paid by Medicaid or private insurance may indicate whether total utilization has changed for SNHs and non-SNHs in expansion and nonexpansion states. Thus, second, we examined the absolute number of stays and visits by which each payer was above or below trend on average per quarter in 2016.

Regression Analysis

Third, using quarterly observations for each hospital and payer group in both expansion and nonexpansion states, we used a triple difference-in-differences (DID) Poisson model with MSA*state*SNH-status fixed effects, as well as state*SNH-status-specific time trends[8,30,31] to accommodate pre-existing secular trends that may have been underway before Medicaid expansion. By including separate time trend terms for the treatment and control group by state, we account for differences in time trends between the two groups in each state. Models clustered standard errors at the state-MSA level. We report estimates for each year in the postexpansion period (2014, 2015, and 2016) to separate early from longer-term effects.

We assessed whether the pre-post percent change in volume differed between hospitals in expansion and nonexpansion states, separately for SNHs and non-SNHs, accounting for pre-expansion trends. Figure 1 displays a conceptual framework for measuring the effect of Medicaid expansion.[32] It shows the household income level of populations likely to switch insurance in the postexpansion period in both types of states. By comparing utilization in expansion and nonexpansion states, we measured the effect of expanding Medicaid separate from the effects of other health care policies (i.e., woodwork, marketplace, and individual mandate effects), as those policies are implemented in the absence of Medicaid expansion.

Finally, we compared the Medicaid expansion effect for SNHs with the effect for non-SNHs. This "triple difference" comparison speaks to the differential impact of Medicaid expansion on SNHs versus non-SNHs.

We report regression results in terms of percent changes.[8,33–35] SNHs serve a larger number of Medicaid and uninsured patients than do non-SNHs and understandably have larger absolute changes in volume for these populations. In contrast, percent changes reflect the experience of SNHs and non-SNHs relative to their base caseload of Medicaid, self-pay/no charge, and privately insured patients. They measure whether the rate of change in utilization was faster or slower for SNHs than for non-SNHs in expansion states, relative to pre-expansion trends and their nonexpansion counterparts.

Figure 1. Conceptual framework for assessing the Medicaid expansion effect in safety-net hospitals and non-safety-net hospitals
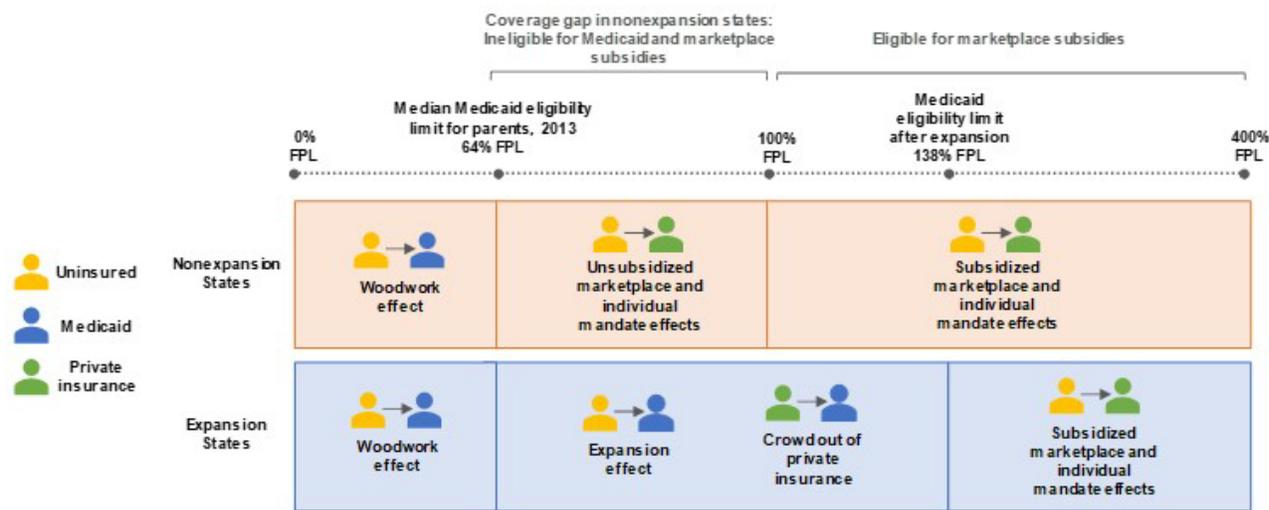
Source for the median eligibility limit for parents: Kaiser Family Foundation. *Medicaid Income Eligibility Limits for Parents, 2002-2019*. 2019. Available at: https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D. Accessed April 20, 2020.

FPL indicates Federal Poverty Level.

RESULTS

Descriptive Results

Figure 2 (panel a) displays average quarterly Medicaid inpatient and ED volumes by safety-net and Medicaid expansion status. Projected trends, starting in first quarter 2014, are shown as dotted lines. In expansion states in 2014, there were sharp increases in inpatient stays and ED visits paid by Medicaid at both SNHs and non-SNHs. In contrast, in nonexpansion states Medicaid inpatient stays and ED visits generally were on trend from 2014 through 2016. Historically SNHs have served more Medicaid patients than have non-SNHs, and although still true, this difference has decreased in expansion states. On average per quarter in 2011, the number of Medicaid inpatient stays was 167% higher at SNHs than at non-SNHs, but in 2016 it was only 108% higher. In nonexpansion states, the number of Medicaid inpatient stays was 100–103% higher at SNHs than at non-SNHs in both 2011 and 2016.

Figure 2 (panels b and c) display trends in self-pay/no charge and privately insured inpatient and ED volumes, respectively. Beginning in 2014, there was a sharp decrease in self-pay/no charge inpatient stays and ED visits at both SNHs and non-SNHs in expansion states. Even in nonexpansion states, stays and visits billed to self-pay/no charge were below trend in 2014. After January 1, 2014, privately insured inpatient stays were above trend for both SNHs and non-SNHs in expansion and nonexpansion states; ED visits were above trend for SNHs and non-SNHs only in nonexpansion states.

Figure 2. Observed and projected numbers of Medicaid, self-pay/no charge, and privately insured inpatient stays and ED visits among safety-net and non-safety-net hospitals in Medicaid expansion and nonexpansion states, 2011–2016
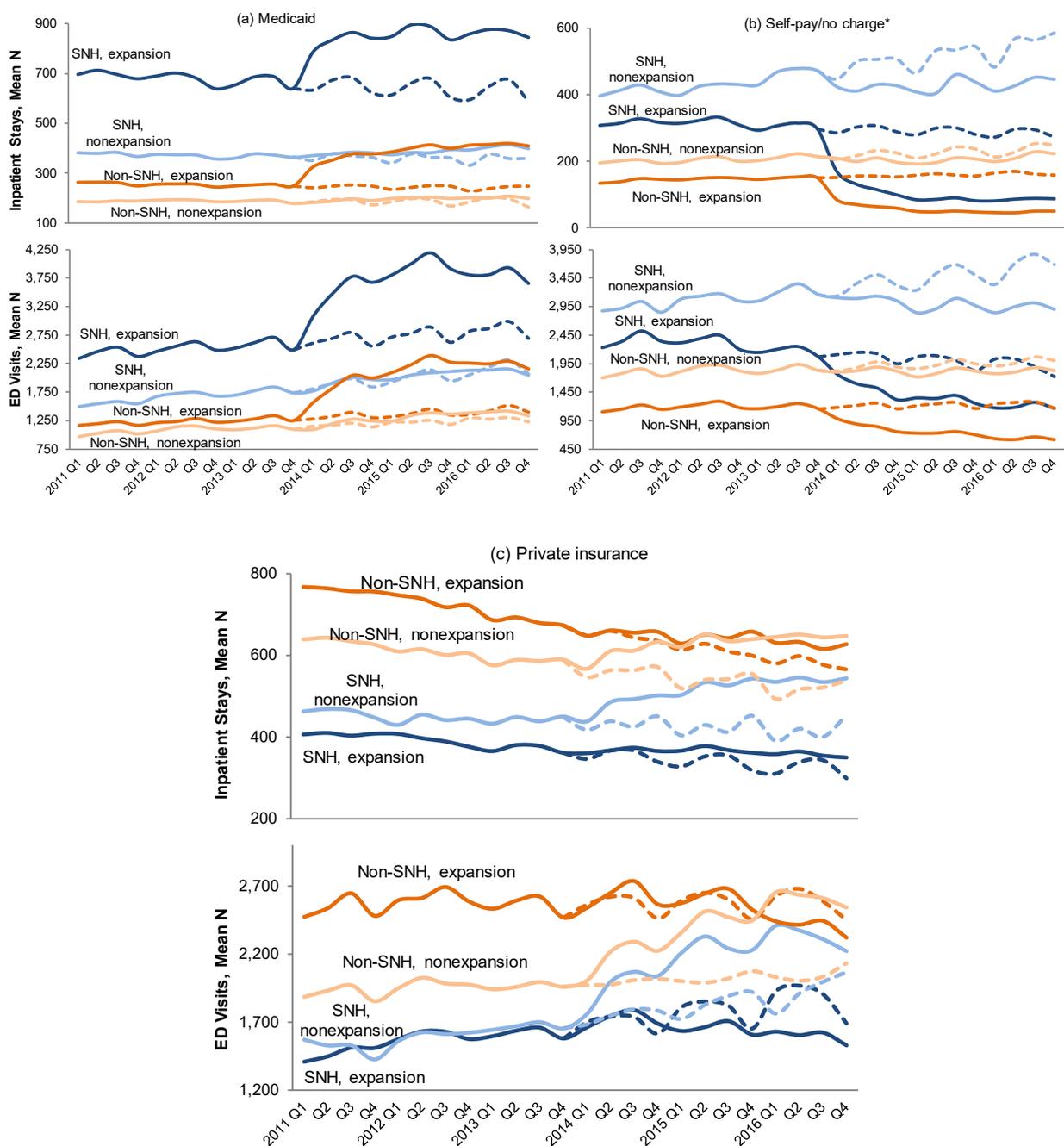
* Self-pay/No charge: includes self-pay, no charge, charity, and no expected payment.

Inpatient stays and ED visits were limited to nonmaternal stays among adults aged 19–64 years.

ED indicates emergency department; Q indicates quarter; SNH indicates safety-net hospital.

Figure 3 shows the number of stays by which each payer was above or below trend on average per quarter in 2016. In the inpatient setting, self-pay/no charge stays were below trend by 198 and 115 stays on average per quarter in 2016 for SNHs and non-SNHs, respectively, in expansion states and by 116 and 20 stays for SNHs and non-SNHs, respectively, in nonexpansion states. These decreases were more than offset by increases in Medicaid and privately insured stays, which taken together were above trend (by 268, 219, 170, and 145 stays, respectively, for SNHs in expansion states, non-SNHs in expansion states, SNHs in nonexpansion states, and non-SNHs in nonexpansion states). Whereas in expansion states these increases came mostly from Medicaid stays, in nonexpansion states the increases came mostly from stays paid by private insurance.

In the ED setting, in expansion states, decreases in self-pay/no charge and privately insured ED visits (which in aggregate were 991 and 791 visits below trend on average per quarter in 2016 for SNHs and non-SNHs, respectively) were almost equally offset by gains in Medicaid visits (which were 958 and 824 visits above trend for SNHs and non-SNHs, respectively).

Figure 3. Degree to which inpatient stays and ED visits were above or below trend on average per quarter in 2016, by payer and safety-net and state Medicaid expansion status
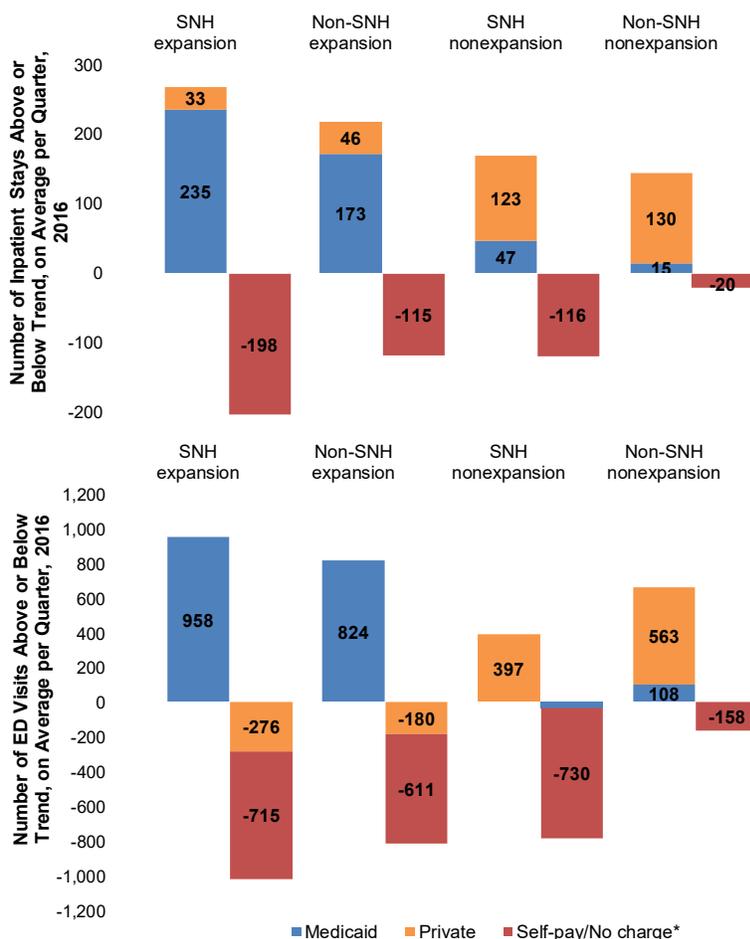

* Self-pay/No charge: includes self-pay, no charge, charity, and no expected payment.

Inpatient stays and ED visits were limited to nonmaternal stays among adults aged 19–64 years.

ED indicates emergency department; SNH indicates safety-net hospital.

Regression Results

Regression results are shown in Table 1. Medicaid expansion was associated with a greater relative increase in Medicaid inpatient stays proportionate to base caseload for non-SNHs than for SNHs. This disparity increased with time and was not observed for Medicaid ED visits. In 2014, compared with the pre-expansion period, Medicaid expansion was associated with a smaller percentage increase in Medicaid inpatient stays at SNHs (24.2%, P=0.005) than at non-SNHs (41.1%, P<0.001) (triple difference: –12.0%; 95% confidence interval [CI]: –19.4%, –3.8%; P=0.005). In comparison, in 2016, the expansion effects for Medicaid inpatient stays were 22.6% (P=0.065) for SNHs and 52.4% (P<0.001) for non-SNHs (triple difference: –19.6%; 95% CI: –31.4%, –5.7%; P=0.007). Thus, the difference between the expansion effects for non-SNHs and SNHs appears to have been larger in 2016 than in 2014, although the confidence intervals for the triple differences overlapped. With respect to ED visits, Medicaid expansion was associated with a statistically significant increase in Medicaid ED visits, comparing expansion states with nonexpansion states (e.g., in 2016, 26.1%, P=0.039, at SNHs and 35.9%, P=0.052, at non-SNHs). However, the effects were not significantly different between SNHs and non-SNHs (triple difference: –7.2%, P=0.300).

With respect to self-pay/no charge stays, Medicaid expansion was associated with similar percentage decreases for SNHs (e.g., in 2016, –62.7%, P<0.001) and non-SNHs (–68.0%, P<0.001) (triple difference: 16.5%, P=0.493). In contrast, in the ED setting, Medicaid expansion was associated with fewer self-pay/no charge visits initially for both SNHs and non-SNHs, but this effect diminished over time for SNHs. In 2014, compared with the pre-expansion period, Medicaid expansion was associated with similar percentage decreases in self-pay/no charge ED visits at SNHs (–20.5%, P=0.004) and non-SNHs (–24.6%, P<0.001) (triple difference: 5.4%; 95% CI: –7.2%, 19.7%; P=0.421). By 2016, Medicaid expansion was associated with fewer self-pay/no charge ED visits for non-SNHs (–43.0%, P<0.001) but not for SNHs (–24.2%, P=0.23.7) (triple difference: 33.0%; 95% CI: –0.8%, 78.2%; P=0.057).

Medicaid expansion was associated with a statistically significant decrease in privately insured inpatient stays only for non-SNHs, and this trend appeared to increase over time. In 2014, compared with the pre-expansion period, privately insured inpatient stays at non-SNHs decreased by 5.7% (95% CI: –8.1%, –3.3%; P<0.001) more in expansion states than in nonexpansion states. In 2016, this effect for non-SNHs was –12.8% (95% CI: –17.5%, –7.8%; P=0.002). For privately insured ED visits, Medicaid expansion was associated with a decrease in visits for both SNHs and non-SNHs, with no significant difference in the effect between these two types of hospitals in each year.

We generally did not observe any statistically significant effect of Medicaid expansion on combined Medicaid, self-pay/no charge, and privately insured utilization of inpatient or ED care for SNHs or non-SNHs.

TABLE 1. Regression Results*

Variable	2014 vs. Pre-ACA		2015 vs. Pre-ACA		2016 vs. Pre-ACA	
	DID Expansion vs. Nonexpansion	DID Comparison SNHs vs. Non-SNHs	DID Expansion vs. Nonexpansion	DID Comparison SNHs vs. Non-SNHs	DID Expansion vs. Nonexpansion	DID Comparison SNHs vs. Non-SNHs
	β	β (95% CI)	β	B (95% CI)	β	β (95% CI)
Inpatient stays						
Medicaid		0.120§ (−0.194, −0.038)		−0.134§ (−0.232, −0.025)		−0.196§ (−0.314, −0.057)
SNH	0.242‡		0.288‡		0.226	
Non-SNH	0.411‡		0.488‡		0.524‡	
Self-pay/No charge│		0.007 (−0.253, 0.357)		0.011 (−0.290, 0.441)		0.165 (−0.247, 0.804)
SNH	−0.507‡		−0.647‡		−0.627‡	
Non-SNH	−0.510‡		−0.651‡		−0.680‡	
Private		0.011 (−0.048, 0.074)		0.018 (−0.090, 0.139)		0.026 (−0.097, 0.166)
SNH	−0.047		−0.087		−0.105	
Non-SNH	−0.057‡		−0.103‡		−0.128‡	
Total†		0.030 (−0.036, 0.101)		0.048 (−0.063, 0.172)		0.065 (−0.062, 0.209)
SNH	0.033		0.037		0.043	
Non-SNH	0.002		−0.010		−0.021	
ED visits						
Medicaid		−0.064 (−0.142, 0.022)		−0.066 (−0.147, 0.022)		−0.072 (−0.194, 0.069)
SNH	0.269‡		0.358‡		0.261‡	
Non-SNH	0.355‡		0.454‡		0.359	
Self-pay/No charge│		0.054 (−0.072, 0.197)		0.175 (−0.058, 0.465)		0.330 (−0.008, 0.782)
SNH	−0.205‡		−0.225		−0.242	
Non-SNH	−0.246‡		−0.340‡		−0.430‡	
Private		−0.050 (−0.115, 0.019)		−0.114 (−0.273, 0.080)		−0.057 (−0.245, 0.177)
SNH	−0.113‡		−0.259‡		−0.314‡	
Non-SNH	−0.066‡		−0.164‡		−0.272‡	
Total†		0.017 (−0.023, 0.059)		0.056 (−0.001, 0.116)		0.119§ (0.015, 0.234)
SNH	0.036		0.057		0.015	
Non-SNH	0.018		0.001		−0.093	

* Included nonmaternal stays and visits among adults aged 19–64 years.

† Total includes Medicaid plus uninsured plus private insurance

‡ *P*-value testing difference in percent change between hospitals in expansion versus nonexpansion states, <0.05.

§ *P*-value testing difference in DID estimates between SNHs and non-SNHs, <0.05

│ Self-pay/No charge: includes self-pay, no charge, charity, and no expected payment.

ACA indicates Affordable Care Act; CI indicates confidence interval; DID indicates difference-in-differences; SNH indicates safety-net hospital; ED indicates emergency department.

DISCUSSION

Following expansion, self-pay/no charge inpatient stays and ED visits among adults aged 19–64 years reached historic lows in Medicaid expansion states. This undoubtedly improved the finances of both SNHs and non-SNHs. Proportionate to their base Medicaid caseloads, Medicaid expansion was associated with larger increases in Medicaid inpatient stays for non-SNHs than for SNHs, and this differential accelerated between 2014 and 2016. Thus, Medicaid expansion has reduced and may continue to reduce the concentration of Medicaid inpatients at SNHs, which may have positive and negative implications, for patients and for SNHs.

On the positive side, this finding may signal improved access to care and treatment options for new Medicaid beneficiaries. Additionally, SNHs often experience resource constraints and budget reductions that result in eliminating rather than expanding service lines,[36] as well as workforce capacity constraints such as difficulty recruiting specialist physicians and ensuring appropriate levels of diverse hospital staff.[37] From a health system perspective, a redistribution of Medicaid inpatients toward non-SNHs may help alleviate the capacity and resource issues faced by many SNHs, which already treat a disproportionately high share of low-income individuals.

However, taken together with other results from our study, this finding raises several concerns. First, a reduced concentration of Medicaid stays at SNHs, compared with non-SNHs, suggests that SNHs may be experiencing greater competition for Medicaid inpatients. Newly insured individuals generally have more options for hospital care, especially in urban markets with more competition, and may elect to use non-SNHs on the basis of proximity, quality of care, or reputation.[38] Newly insured patients may view non-SNHs as having superior amenities, less crowding, and better care and consequently may perceive SNHs as lower-quality options. This notion is reinforced by reports showing, although not uniformly,[39,40] that SNHs are more likely to score lower on several hospital quality measures[41] and are relatively slow to improve quality in response to value-based payment reform.[42] However, this apparent quality gap may reflect a failure of some studies to fully adjust for patient mix. Still, to compete with non-SNHs, SNHs may need to shake their persistent image as a "provider of last resort" by ensuring that quality of care and patient experience are at the core of future strategic planning.[43,44]

Second, we saw a redistribution of Medicaid inpatient stays toward non-SNHs but did not see a redistribution of Medicaid ED visits. This finding is concerning because ED services have tight financial margins and are associated with sizable Medicaid payment shortfalls.[45] Non-SNHs could be attracting healthier Medicaid patients, including those with planned inpatient stays, leaving those who are sicker and use more ED services at SNHs. Historically, Medicaid expansion has been associated with a transfer of healthier patients from SNHs toward non-SNHs.[11]

Third, whereas Medicaid inpatients became less concentrated at SNHs following expansion, these hospitals continue to disproportionately care for the stays billed to self-pay/no charge, which are likely to be uninsured. Medicaid expansion was associated with similar percentage decreases in self-pay/no charge inpatient stays and initially in self-pay/no charge ED visits, across SNHs and non-SNHs. However, by 2016, the pre-post ACA percentage decrease in self-pay/no charge ED visits no longer was statistically different between SNHs in expansion versus nonexpansion states. For non-SNHs, the expansion effect was stronger in 2016 than in 2014. SNHs historically have treated marginalized populations, which may be more likely to remain uninsured after expansion. The uninsured patients of non-SNHs may have higher incomes and may be more likely to enroll in Medicaid or marketplace plans, finding their way into primary

care systems as time goes on. These findings suggest that, in the future, SNHs may continue to play a central role in serving individuals who lack insurance and rely on the ED for primary care.

We can also comment on whether our data are consistent with woodwork and crowd-out effects. Although the literature is mixed,[46] some authors have found sizable woodwork effects. Medicaid enrollment has increased in all but two states.[4,6,47] We did not find evidence of such effects in acute care settings. In nonexpansion states, Medicaid inpatient stays and ED visits generally were on trend between 2014 and 2016.

Whereas other studies have found negligible decreases in population rates of private insurance following Medicaid expansion,[6,46,47] some of our findings are consistent with a crowd-out of private insurance by Medicaid in the ED setting. In expansion states, decreases in self-pay/no charge and privately insured ED visits were almost equally offset by gains in Medicaid visits. This finding is consistent with the notion that ED patients who were previously privately insured or uninsured may have switched to Medicaid after the expansion. A crowd-out of private insurance in the ED setting was recently noted in California.[48]

Finally, research suggests that insurance expansions result in more use of both inpatient and ED care,[19,20,49] although such effects may be temporary. We did not find that combined Medicaid plus self-pay/no charge plus private utilization of inpatient or ED care was higher in expansion than in nonexpansion states. That said, in 2016, Medicaid and privately insured inpatient stays were above trend to a greater degree than self-pay/no charge inpatient stays were below trend for all groups of hospitals, potentially signaling an increase in inpatient utilization associated with Medicaid and marketplace expansions for SNHs and non-SNHs in both expansion and nonexpansion states.

Our study has several important limitations. Our data do not enable tracking of individual patients from one type of hospital to another. Additionally, we cannot isolate hospital use for populations with incomes under 138% FPL that became newly eligible for Medicaid in expansion states; we can only observe average changes in utilization by Medicaid, self-pay/no charge, and privately insured patients. It also may be difficult to interpret inpatient results in conjunction with ED visit results when they are not for the same set of states. We have included the inpatient results, limited to states that also provided ED data, in the Appendix. The results are similar to those presented here. Finally, expected payer is an imprecise measure; it may be recorded incorrectly (e.g., Medicaid managed care plans recorded as private insurance) and may not be the final payer for the hospital stay or visit.

CONCLUSION

Uninsured inpatient stays and ED visits have decreased, and Medicaid inpatient stays have become less concentrated at SNHs following Medicaid expansion, potentially reducing financial pressures associated with high levels of uncompensated care and alleviating resource and capacity issues faced by SNHs. Yet our findings also suggest that SNHs continue to shoulder a disproportionate amount of care for uninsured inpatients, as well as for Medicaid and uninsured patients in the ED. SNHs are likely to face a unique set of ongoing challenges as health care policies evolve. These hospitals should be monitored closely to ensure that a safety net for the poor and uninsured remains intact.

REFERENCES

1. Decker SL, Lipton BJ, Sommers BD. Medicaid expansion coverage effects grew in 2015 with continued improvements in coverage quality. *Health Aff (Millwood).* 2017;36(5):819–825.
2. Carman KG, Eibner C, Paddock SM. Trends in health insurance enrollment, 2013-15. *Health Aff (Millwood).* 2015;*34*(6):1044–1048.
3. Kaiser Family Foundation. *Marketplace Enrollment as a Share of the Potential Marketplace.* 2019. Available at: https://www.kff.org/health-reform/state-indicator/marketplace-plan-selections-as-a-share-of-the-potential-marketplace-population/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D. Accessed December 10, 2020.
4. Medicaid and CHIP Payment and Access Commission. *Medicaid Enrollment Changes Following the ACA*. 2018. Available at: www.macpac.gov/subtopic/medicaid-enrollment-changes-following-the-aca/. Accessed April 20, 2020.
5. Sommers BD, Musco T, Finegold K, et al. Health reform and changes in health insurance coverage in 2014. *N Engl J Med.* 2014;371(9):867–874.
6. Frean M, Gruber J, Sommers BD. Premium subsidies, the mandate, and Medicaid expansion: coverage effects of the Affordable Care Act. *J Health Econ.* 2017;53:72–86.
7. Nikpay S, Buchmueller T, Levy HG. Affordable Care Act Medicaid expansion reduced uninsured hospital stays in 2014. *Health Aff (Millwood).* 2016;35(1):106–110.
8. Wu VY, Fingar KR, Jiang HJ, et al. Early impact of the Affordable Care Act coverage expansion on safety-net hospital inpatient payer mix and market shares. *Health Serv Res.* 2018;53(5):3617–3639.
9. Health Grades. *American Hospital Quality Outcomes 2014: Healthgrades Report to the Nation: Executive Summary.* 2013. Available at: www.bronsonhealth.com/app/files/public/1007/2013-american-hospital-quality-outcomes-2014-healthgrades-report-to-the-nation.pdf. Accessed April 20, 2020.
10. Hill SC, Abdus S, Hudson JL, Selden TM. Adults in the income range for the Affordable Care Act's Medicaid expansion are healthier than pre-ACA enrollees. *Health Aff (Millwood).* 2014;33(4):691–699.
11. Gaskin DJ, Hadley J, Freeman VG. Are urban safety-net hospitals losing low-risk Medicaid maternity patients? *Health Serv Res.* 2001;36:25–51.
12. Kaiser Family Foundation. *Key Facts About the Uninsured Population*. 2018. Available at: www.kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/. Accessed April 20, 2020.
13. Shartzer A, Kenney GM, Long SK, Odu Y. *A Look at Remaining Uninsured Adults as of March 2015*. Washington, DC: Urban Institute; 2015.
14. Garfield R, Orgera K. *The Coverage Gap: Uninsured Poor Adults in States That Do Not Expand Medicaid.* Henry J. Kaiser Foundation; 2019. Available at: https://www.kff.org/medicaid/issue-brief/the-coverage-gap-uninsured-poor-adults-in-states-that-do-not-expand-medicaid/. Accessed April 20, 2020.
15. California Healthcare Foundation. *Overuse of Emergency Departments Among Insured Californians*. 2006. Available at: www.chcf.org/wp-content/uploads/2017/12/PDF-EDOveruse.pdf. Accessed April 20, 2020.
16. Burke G, Paradise J. *Safety-Net Emergency Departments: A Look at Current Experiences and Challenges*. Kaiser Family Foundation; 2015. Available at: www.kff.org/medicaid/issue-brief/safety-net-emergency-departments-a-look-at-current-experiences-and-challenges/view/print/. Accessed April 20, 2020.

17. American Hospital Association. *Increasing Consumer Choice in Coverage and Care: Implications for Hospitals.* 2014. Available at: www.aha.org/research/reports/tw/14june-tw-consumerchc.pdf. Accessed April 20, 2020.
18. Cunningham P, Sabik LM, Bonakdar Tehrani A. Trends in hospital inpatient admissions following early Medicaid expansion in California. *Med Care Res Rev.* 2017;74(6):705–722.
19. Medford-Davis LN, Eswaran V, Shah RM, Dark C. The Patient Protection and Affordable Care Act's effect on emergency medicine: a synthesis of the data. *Ann Emerg Med.* 2015;66(5):496–506.
20. Lo N, Roby DH, Padilla J, et al. *Increased Service Use Following Medicaid Expansion Is Mostly Temporary: Evidence From California's Low Income Health Program.* Policy brief. Los Angeles, CA: UCLA Center for Health Policy Research; 2014.
21. Bazzoli GJ, Fareed N, Waters TM. Hospital financial performance in the recent recession and implications for institutions that remain financially weak. *Health Aff (Millwood).* 2014;33(5):739–745.
22. Reiter KL, Jiang HJ, Wang J. Facing the recession: how did safety-net hospitals fare financially compared with their peers? *Health Serv Res.* 2014;49(6):1747–1766.
23. Coughlin TA, Holahan J, Caswell K, McGrath M. *Uncompensated Care for the Uninsured in 2013: A Detailed Examination.* Kaiser Family Foundation; 2014. Available at: https://www.kff.org/uninsured/report/uncompensated-care-for-the-uninsured-in-2013-a-detailed-examination/. Accessed April 20, 2020.
24. Lasser KE, Hanchate AD, McCormick D, et al. Massachusetts health reform's effect on hospitals' racial mix of patients and on patients' use of safety-net hospitals. *Med Care.* 2016;54(9):827–836.
25. Neuhausen K, Davis AC, Needleman J, et al. Disproportionate-share hospital payment reductions may threaten the financial stability of safety-net hospitals. *Health Aff (Millwood).* 2014;33(6):988–996.
26. Gilman M, Adams EK, Hockenberry JM, et al. The financial effect of value-based purchasing and the hospital readmissions reduction program on safety-net hospitals in 2014: a cohort study. *Ann Intern Med.* 2015;163(6):427–436.
27. Healthcare Cost and Utilization Project. Databases. Agency for Healthcare Research and Quality; 2018. Available at: https://www.hcup-us.ahrq.gov/databases.jsp. Accessed April 20, 2020.
28. Institute of Medicine. *America's Health Care Safety Net: Intact but Endangered.* Washington, DC: National Academy Press; 2000.
29. Barrett ML, Lopez-Gonzalez A, Hines R, et al. *An Examination of Expected Payer Coding in HCUP Databases.* HCUP Methods Series Report 2014-03. Rockville, MD: Agency for Healthcare Research and Quality; 2014.
30. Kasy M. *Quantitative Methods in Economics: Causality and Treatment Effects.* Slide presentation. 2016. Available at: https://scholar.harvard.edu/files/kasy/files/5-difference-in-differences.pdf. Accessed April 20, 2020.
31. Imbens G, Wooldridge J. *Difference-in-Differences Estimation.* National Bureau of Economic Research Lecture Notes 10. 2007. Available at: https://www.nber.org/WNE/lect_10_diffindiffs.pdf. Accessed April 20, 2020.
32. Kaiser Family Foundation. *Medicaid Income Eligibility Limits for Parents, 2002-2019.* 2019. Available at: https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D. Accessed April 20, 2020.
33. Ciani E, Fisher P. Dif-in-Dif Estimators of Multiplicative Treatment Effects. *J Econometric Methods.* 2019;8(1):1–10.
34. Santos Silva JMC, Tenreyro S. The log of gravity. *Rev Econ Statistics.* 2006;88(4):641–658.

35. Cameron AC, Trivedi PK. Count panel data. In: Baltagi BH, ed., *The Oxford Handbook of Panel Data.* Oxford University Press: 2015. Available at: http://cameron.econ.ucdavis.edu/research/OXFHNDBK13preprint.pdf. Accessed April 20, 2020.

36. Cole ES, Walker D, Mora A, Diana ML. Identifying hospitals that may be at most financial risk from Medicaid disproportionate-share hospital payment cuts. *Health Aff (Millwood).* 2014;33(11):2025–2033.

37. Bazzoli GJ, Brewster LR, May JH, Kuo S. The transition from excess capacity to strained capacity in U.S. hospitals. *Milbank Q.* 2006;84(2):273–304.

38. Porell FW, Adams EK. Hospital choice models: a review and assessment of their utility for policy impact analysis. *Med Care Res Rev.* 1995;52(2):158–195.

39. Jiang HJ, Reiter KL, Wang J. Measuring mortality performance: how did safety-net hospitals compare with other hospitals? *Med Care.* 2016;54(7):648–656.

40. Ross JS, Bernheim SM, Lin Z, et al. Based on key measures, care quality for Medicare enrollees at safety-net and non-safety-net hospitals was almost equal. *Health Aff (Millwood).* 2012;31(8):1739–1748.

41. Ross JS, Cha SS, Epstein AJ, et al. Quality of care for acute myocardial infarction at urban safety-net hospitals. *Health Aff (Millwood).* 2007;26(1):238–248.

42. Werner RM, Goldman LE, Dudley RA. Comparison of change in quality of care between safety-net and non-safety-net hospitals. *JAMA.* 2008;299(18):2180–2187.

43. Kahn HA. What changes are needed to enable the safety net to become a provider of choice? and how does it get done? *J Health Polit, Policy, Law.* 2015;40(2):395–401.

44. Murphy J, Ko M, Kizer KW, Bindman AB. Safety net integration: a shared strategy for becoming providers of choice. *J Health Polit, Policy, Law.* 2015;40(2):403–419.

45. Wilson M, Cutler D. Emergency department profits are likely to continue as the Affordable Care Act expands coverage. *Health Aff (Millwood).* 2014;33(5):792–799.

46. Antonisse L, Garfield R, Rudowitz R, Artiga S. *The Effects of Medicaid Expansion Under the ACA: Updated Findings From a Literature Review.* Kaiser Family Foundation; 2018. Retrieved from http://files.kff.org/attachment/Report-The-Effects-of-Medicaid-Expansion-under-the-ACA-Updated-Findings-from-a-Literature-Review.pdf. Accessed April 20, 2020.

47. Frean M, Gruber J, Sommers BD. Disentangling the ACA's coverage effects—lessons for policymakers. *N Engl J Med.* 2016;375(17):1605–1608.

48. Ellis C, Esson M. *Medicaid Expansion, Crowd-Out, and Emergency Department Utilization: Evidence from California's Bridge to Reform Medicaid.* Fox School of Business Research Paper No. 18-038. 2018. Available at: https://ssrn.com/abstract=3214825. Accessed April 20, 2020.

49. Buchmueller TC, Grumbach K, Kronick R, Kahn JG. The effect of health insurance on medical care utilization and implications for insurance expansion: a review of the literature. *Med Care Res Review.* 2005;62(1):3–30.

Data for this study came from 20 State Inpatient Databases (SID) and 13 State Emergency Department Databases (SEDD) for which the state contained at least one large metropolitan statistical area (MSA). We included SID from Arizona, California, Colorado, Florida, Georgia, Illinois, Maryland, Missouri, North Carolina, New Jersey, Nevada, New York, Ohio, Oklahoma, Oregon, Rhode Island, Tennessee, Texas, Virginia, and Washington. We included SEDD from Arizona, California, Florida, Georgia, Illinois, Maryland, Missouri, North Carolina, New Jersey, New York, Ohio, Rhode Island, and Tennessee. Indiana, Michigan, Pennsylvania, and Wisconsin also contained large MSAs but were excluded because the first three states implemented the Medicaid expansion late, after January 1, 2014, and Wisconsin expanded Medicaid through its Badgercare program in 2009, although it did not adopt the Medicaid expansion as of January 1, 2014.
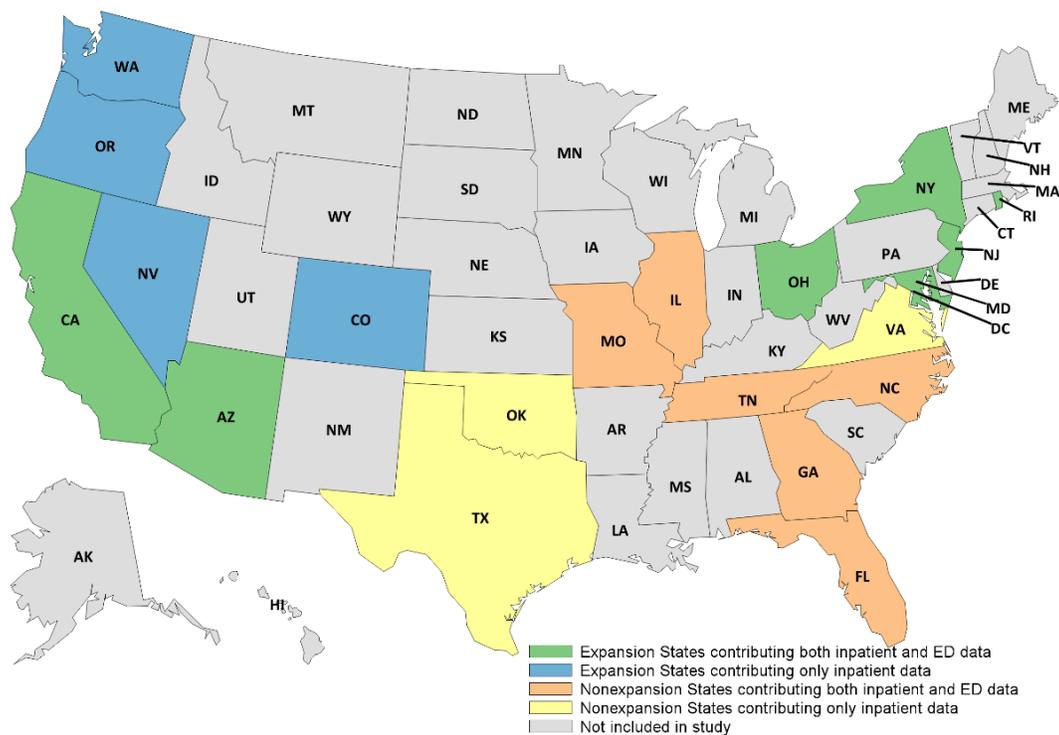
Note that because our primary question of interest was related to the effect of the Medicaid expansion, and Medicaid expansion policies are state specific and require enrollees to receive care in their state of residence, MSAs that spanned multiple states were split along state boundaries and defined as separate markets. We then evaluated each market independently to ensure that it met the inclusion criterion of having at least 1 million residents.

Also note that before applying our exclusion criteria, we defined safety-net status. Thus, all nonfederal general acute care hospitals in a state were included in the ranking of hospitals according to their percentage of Medicaid plus uninsured inpatient stays (i.e., we included hospitals outside large MSAs, hospitals with fewer than 25 beds, and hospitals without data in each year as long as they contributed to the preperiod from 2011–2013).

Regarding the model specification, we used observations defined at the hospital × quarter level for each payer group, and separately for inpatient and ED data, to employ the following empirical specification (analyses were done in SAS version 9.4):

$$y_{it} = \exp(\alpha_{\text{MSA·SNH}} + \lambda_q + \gamma_{\text{STATE·SNH}} \cdot c_t + \tau_{expand \cdot SNH \cdot 2014} + \tau_{expand \cdot SNH \cdot 2015} + \tau_{expand \cdot SNH \cdot 2016}) + \varepsilon_{it}$$

In this notation, y_{it} is the encounter volume for hospital i in time period t and c_t is the representation of time as a continuous variable. Subscripted coefficients denote vectors of indicator functions, with an element for each combination the subscripts can take on. Thus, $\alpha_{\text{MSA·SNH}}$ represent fixed effects for each group of hospitals defined by stratification along the dimensions of MSA and SNH status. λ_q are four quarterly dummies (one of which drops out) to capture seasonal effects, and $\gamma_{\text{STATE·SNH}} \cdot c_t$ allow for state-SNH status-specific time trends to accommodate pre-existing secular trends that may have been underway before ACA implementation. Standard errors were clustered on MSA.

The τ vector contains the parameters of primary interest, $expand$ denotes expansion status of the state in which the hospital resides, SNH indicates whether the hospital is an SNH, and $2014, 2015, and\ 2016$ are indicators for being in the post-ACA period, defined in this study as 2014 and beyond. Thus, linear combinations of the τ parameters can be used to identify average volume differences in hospitals before and after ACA implementation, separately for combinations of expansion status and SNH status and contrasting any combinations therein. For example, our models can estimate the average incremental effects of the ACA on SNH hospitals in expansion states compared with non-SNH hospitals in expansion states, expressed in terms of incremental semi-elasticities, as follows:

$$\exp\left(\left(\tau_{[expand=1]\cdot[SNH=1]\cdot[post=1]} - \tau_{[expand=1]\cdot[SNH=1]\cdot[2016=0]}\right) - \left(\tau_{[expand=1]\cdot[SNH=0]\cdot[2016=1]} - \tau_{[expand=1]\cdot[SNH=0]\cdot[2016=0]}\right)\right) - 1$$

We calculated other contrasts of interest similarly.

Confidence intervals and *P*-values were obtained via nonparametric clustered bootstrapping with 1,000 replicates per regression, re-estimating each regression. By *clustered bootstrap*, we mean that random sampling was done at the MSA level (stratified by expansion status to ensure proportional representation of expansion and nonexpansion states), with all observations from a selected MSA included in a replicate.

One limitation of our approach is that the models may not meet the Stable Unit Treatment Value Assumption. This assumption states that the potential outcomes of any given unit with and without treatment are independent of the treatment status of any other unit. In our study, the outcome for a given SNH is dependent on whether there are shifts in patient demand to other neighboring hospitals in the same MSA. We proceeded with the regressions as planned but acknowledge that the generalizability of our results may be limited because our findings apply to the set of SNH and non-SNH competitors in our study.

Table A.1. Inpatient Regression Results Limited to States With Both Inpatient and ED Data

Variable	2014 vs. Pre-ACA DID Expansion vs. Nonexpansion		2014 vs. Pre-ACA DID Comparison SNHs vs. Non-SNHs		2015 vs. Pre-ACA DID Expansion vs. Nonexpansion		2015 vs. Pre-ACA DID Comparison SNHs vs. Non-SNHs		2016 vs. Pre-ACA DID Expansion vs. Nonexpansion		2016 vs. Pre-ACA DID Comparison SNHs vs. Non-SNHs	
	β	P	β	P	β	P	β	P	β	P	β	P
Inpatient stays, N												
Medicaid			−0.124	0.004			−0.163	0.002			−0.208	0.001
SNH	0.233	0.006			0.252	0.006			0.211	0.069		
Non-SNH	0.407	<.001			0.496	<0.001			0.530	<0.001		
Self-pay/No charge*			0.056	0.747			0.006	0.975			0.179	0.502
SNH	−0.488	0.001			−0.655	<0.001			−0.624	<0.001		
Non-SNH	−0.515	<0.001			−0.657	<0.001			−0.681	<0.001		
Private			0.017	0.616			0.022	0.721			0.029	0.672
SNH	−0.048	0.186			−0.099	0.114			−0.129	0.032		
Non-SNH	−0.063	<0.001			−0.118	<0.001			−0.154	<0.001		
Medicaid + self-pay/no charge* + private			0.032	0.281			0.017	0.657			0.038	0.463
SNH	0.028	0.328			−0.003	0.928			0.000	0.991		
Non-SNH	−0.003	0.794			−0.020	0.300			−0.036	0.125		

* Self-pay/No charge: includes self-pay, no charge, charity, and no expected payment.

Inpatient stays and ED visits were limited to nonmaternal stays among adults aged 19–64 years.

ACA indicates Affordable Care Act; DID indicates difference-in-differences; SNH indicates safety-net hospital; ED indicates emergency department.