Effects of opting-out from federal nurse anesthetists' supervision requirements on anesthesiologist work patterns

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Abstract

Objective: To estimate the impact of opting-out from Medicare supervision requirements for certified registered nurse anesthetists (CRNAs) on anesthesiologists' work patterns.

Data Sources/Study Setting: Secondary data from two national surveys of anesthesiologists and the Area Health Resource File.

Study Design: We use a matching difference-in-difference regression which contrasts the change in work patterns for anesthesiologists in California, which dropped supervision requirements, to the change for similar anesthesiologists. Key outcome variables include the number of weekly hours worked, the type of work done, and type of care delivery teams.

Data Collection/Extraction Methods: Self-reported national survey data drawn from members of the American Society of Anesthesiologists.

Principal Findings: Anesthesiologists in California saw no change in time spent working or time spent supervising CRNAs. There was a decrease in direct care clinical work hours along with a shift in working more in intraoperative care, a decrease in postoperative care, and an increase in the percentage of cases supervising residents.

Conclusions: Anesthesiologists had small but real responses to California's decisions to opt-out of the physician supervision requirement for CRNAs, doing more work in intraoperative care and less outside of the operating room. Total hours worked saw no change.

KEYWORDS

health providers, scope of practice, work environment

1 | INTRODUCTION

Ability to gain access to qualified health care providers remains an important policy issue in the United States.¹ Particularly, access to qualified anesthesia providers is challenging, especially in rural communities.²⁻⁴ One potential solution that has been proposed is to grant certified registered nurse anesthetists more autonomy in their ability to deliver anesthesia without direct physician supervision. This might be accomplished by relaxing regulations that govern the

types of services that CRNAs can provide autonomously. Another potential solution is CRNAs to be allowed to bill under their own license as opposed to under a physicians' license.

Importantly, each state establishes scope-of-practice regulations that govern the care that CRNAs can provide without the direction or supervision of an anesthesiologist. Approximately 19 states allow anesthesia to be provided by CRNAs without any supervision or direction from a physician.⁵ In addition to state these scope-of-practice (SOP) regulations, CMS also imposes restrictions on CRNA

autonomy. Medicare conditions of participation (CoP) for health care facilities require that CRNAs be supervised by either an operating physician or have an immediately available anesthesiologist on premise.⁶ However, in 2001, CMS issued a rule allowing states to “opt-out” of the physician supervision requirement. If the governor of a state wishes to pursue the opt-out, they issue a letter directly to CMS requesting the same. Once processed, the effect is that CRNAs are able to directly bill Medicare and are opted out of the physician supervision requirement. As of February 2017, seventeen states have exercised the exemption.⁷

These Medicare opt-out rules have been controversial with the American Society of Anesthesiologists (ASA) opposing state opt-outs arguing that anesthesiologists alone have the education necessary to ensure patient safety and further arguing that anesthesia is best delivered in physician-lead teams.⁸ The American Association of Nurse Anesthetists (AANA) has advocated at the federal and state levels for the past 15 years in favor of state opt-out decisions arguing that CRNAs can safely deliver anesthesia.⁹

Despite the significant controversy over state opt-out rules, there has been surprisingly little research on the effect of these decisions. Some research has been conducted to understand the effect of these opt-out rules on access to care, quality of care, and patient outcomes. One study found that state opt-outs were associated with no increases in risk of death or complications.¹⁰ Another study determined that CRNAs are a cost-effective solution as they can provide care at a lower cost.¹¹ Three other studies have indicated that state opt-out have failed to yield significant improvements in patient access to anesthesia services.¹²⁻¹⁴ There is some evidence that opting-out is related to higher CRNA supply in rural communities.¹⁵ The effect of opt-outs on cost and quality is predicated on the assumption that opt-outs lead to differences in practice environments within the opt-out states. For example, if states opt-out, but hospital systems still require physician oversight of CRNA practice, we would expect little effect of opt-out on quality and access.

On the other hand, there has been no research more generally into how expansions in APP (of which CRNAs are one example) autonomy might affect physician work patterns. The impacts of expanded autonomy of APPs on the related physicians' work patterns is ambiguous, depending on how the APPs are used (as complements or substitutes or, as is more likely, a mixture of the two) and, secondarily, where APPs and physicians are located. Some APPs will likely continue to serve as complements to physician practices with expanded autonomy, but some may operate as substitutes. Insofar as there is heterogeneity in training and preferences of the two provider types as well as preferences of patients between the two types of providers, expanded SOP may change the distribution of types of cases physicians care for as well as the total number of cases.

Our study contributes to the current literature on state CRNA (and thus APP) regulation by examining the effect of a change in opt-out policy in California on anesthesiologist work patterns. This work pattern analysis will enhance understanding of the effect of changes in CRNA opt-out rules on physician work habits. We examine anesthesiologist work patterns by leveraging two proprietary surveys

TABLE 1 Summary of differences between survey respondents and nonrespondents

	Nonrespondents	Respondents
Age (years)	49.2	50.0*
Female	0.242	0.283*
Urban	0.95	0.946
Northeast	0.227	0.212*
Midwest	0.217	0.226
South	0.331	0.341
West	0.225	0.222

*Significant difference at the .01 level.

of anesthesiologists in which they report on their working patterns. We use a coarsened exact matching (CEM) difference-in-difference (DID) framework to examine how work environments changed for anesthesiologists working in California across the two surveys—between which the state opted out of a Centers for Medicare and Medicaid Services (CMS) requirement for how CRNAs can practice and bill for cases—compared to states that did not change policy between the two surveys.

2 | METHODS

2.1 | Data and variables

We used data drawn from two primary data sources. First, we used data collected on the anesthesiologist work environment from two surveys administered in 2007 and 2013. These surveys were administered by the RAND Corporation and were offered to all members of the American Society of Anesthesiologists (ASA), and funded by the ASA. ASA membership accounts for more than 80 percent of all anesthesiologists practicing in the United States. The response rate in the 2013 survey was 25.6 percent (8178 anesthesiologists); in 2007, the response rate was 22 percent. We include any anesthesiologist who responded in at least one of the years; they need not have answered in both waves. In fact, we cannot identify the anesthesiologists specifically, and so cannot connect respondents in the 2007 survey to the 2013 survey, as we do not have identifying information. Thus, the study considers changes in local health labor market practices and not necessarily changes in given anesthesiologists' behavior. We define labor markets by hospital referral regions (HRRs). Table 1 shows the difference in observable characteristics for respondents and nonrespondents to the survey, reproducing from Baird et al¹⁶ While there are some differences, they are not extreme, and these variables are controlled for in our analysis. Further details on the surveys, including the survey instruments, used previously.^{17,18}

The second data source is the Area Health Resource File (AHRF). The AHRF is a dataset of county-level health information assembled by the Health Resources and Services Administration (HRSA) that is commonly used to describe and project the health care workforce.¹²

The AHRF pulls information about health professionals, facilities, and demographic information from over 50 discrete data sources. From the ARHF, we extracted data on county-level characteristics used as control variables in our models. We then transform the county-level characteristics into HRR-level variables by doing merging the county-level AHRF onto the list of zip codes contained in that county. This is then merged onto the list of HRRs, where are collections of zip codes. When counties cross more than one HRR, the sums and means are divided proportionally within the zip code that is split between counties, the number of HRRs in that county. Consider, for example, Los Angeles County. Four HRRs overlap at least part of Los Angeles County, given how zip codes lie: Los Angeles, Orange County, San Bernardino, and Ventura. Given 484 of the 495 zip codes in Los Angeles County lie in the Los Angeles HRR, 97.78 percent of the sums and means are attributed to the Los Angeles HRR. Baird et al¹⁶ discuss this procedure in more detail.

In addition to the state opt-out status, we also collected a number of control variables about the anesthesiologist, the HRR where the anesthesiologist resides, and the states in which the anesthesiologist resides. At the anesthesiologist level, we collected information on age, sex, marital status, children in household, years at the institution, working teaching (nonprofit) hospital, and years of experience. At the HRR level, we collected data on population, number of surgeries, median income in HRR, number of hospitals and beds, fraction of population over 65, Medicare Advantage Part A and Part B payment rates, Medicare Advantage penetration rate, Medicaid eligibility, local wages, and unemployment rate. All of these but the unemployment rate are acquired from the AHRF; the unemployment rate comes from the Local Area Unemployment Statistics. At the state level, we collected data on the rates of no insurance and HMP penetration rates, also from the AHRF. Table 2 provides the summary statistics on the anesthesiologists and their HRRs for the control variables.

Our outcomes of interest were 20 different variables measuring anesthesiologists' work environment and habits including (a) distribution of an anesthesiologists' time providing various services, (b) distribution of time spent on various anesthetic technique, (c) workload, (d) supervising responsibilities, and (e) income. We present the specific in Table 3. Table 3 also lists the averages for the outcomes, both before the CEM matching and after, as well as the match rate. Take, for example, the first option, the percent time in preoperative care. The CEM methodology is able to find matches for 100 percent of all the treated anesthesiologists. This retains 73 percent of the control anesthesiologists. The 2007 mean in the HRRs of treated anesthesiologists is 7.96 percent of time spent on preoperative care (in both cases here because all of treated anesthesiologists have matches). The mean for all control anesthesiologists is 11.16 percent of time on preoperative care, whereas for the 73 percent of anesthesiologists that match, the mean is 9.27 percent in their HRRs. Note that the means are not constrained to improve through the CEM methodology, for two reasons. First, we are matching not only on the baseline outcome in the HRRs of the anesthesiologists, but on the demographic characteristics of the anesthesiologists, as

described in Section 2, such that balance will improve overall, but not necessarily for each variable we are matching on. Second, CEM matches on coarsened bins, so that the bins will match better, but this does not necessarily imply the mean will improve. However, the means tend to improve in match in most of these cases for the 2007 HRR average outcomes.

2.2 | Analysis approach

We use a coarsened exact matching (CEM) difference-in-difference (DID) strategy to identify the causal effect of Medicare opt-out on anesthesiologist working patterns.¹⁹ The intuition is that we examine how outcomes changed for anesthesiologists in a state that was not an opt-out state in 2007 but was an opt-out state in 2013, and compares the change in outcomes for anesthesiologists in states that do not change status.

We regress each of the workforce outcomes, by anesthesiologist, year, and hospital referral region, on the difference-in-difference framework—HRR, state, and year fixed effects, and an indicator for being in a currently opted-out state. By controlling for state and time fixed effects, the opt-out variable is identified off of within-state variation in opt-out status, which from 2007 to 2013 is as shown in Table 4. We additionally control for anesthesiologist controls, such as age, gender, and experience, as well as state-level variables, such as the HMO penetration rate and the unemployment rate, and HRR-level variables, such as the number of hospitals and number of beds in the HRR. We also control for HRR fixed effects, which absorbs many of the otherwise unobserved characteristics of the local health and work environments.

Given Colorado's limited treatment status, we drop all anesthesiologists in Colorado from the study. Further, Kentucky opted out in 2012; the 2013 survey was administered in May 2013, discussing the previous year, so that it covers only the first year of implementation. This likely did not allow for sufficient time for any changes to happen. We also drop all anesthesiologists in Kentucky from the sample for this reason and focus only on anesthesiologists in California for the treated group (ie, those who worked in a state that changed opt-out status between the two surveys). This then examines the effects a few years after the opt-out, which allows for sufficient time for changes to occur.

One may be concerned that our evaluation is based on only one state. However, the analysis is done at the hospital referral region as discussed, and not the state. With California, we have a wide variety of types of HRRs, from rural to urban and across the socioeconomic stratum. Nonetheless, anesthesiologists in California may be different on average than anesthesiologists in other states and may be working in different types of health markets. Our difference-in-difference strategy relies on the parallel trends assumption, namely that in the absence of treatment, the change in the outcome for the treated group would be the same as for the control group, after controlling for observable factors. While this assumption cannot be directly tested, it is often investigated by comparing the

TABLE 2 Summary statistics of control variables

Variable	Obs.	Mean	SD	Min	Max
Children in household	11 301	1.021	1.261	0	10
Live in urban area	11 278	0.947	0.224	0	1
Work in teaching hospital	10 390	0.415	0.493	0	1
Years of experience	10 932	19.08	9.843	0	63
Age	11 292	49.72	9.328	27	81
Male	11 301	0.76	0.427	0	1
Married	11 301	0.675	0.468	0	1
Has children	11 301	0.513	0.5	0	1
Years in affiliation	10 854	11.22	8.679	0	46
Log population of HRR	11 281	14.34	0.859	11.69	16.13
Log # surgeries in HRR	11 281	11.97	0.851	8.921	13.38
Median income in HRR	11 281	29 285	9819	4929	71 990
Number of beds in HRR	11 281	7067	5667	281.6	25 736
Number of hospitals in HRR	11 281	38.85	28.3	1.9	120.5
Fraction of population over 65 in HRR	11 281	0.13	0.0233	0.0666	0.297
Local wages	11 281	7310	11 807	217.1	60 337
Unemployment rate	11 281	3.757	1.622	0.512	11.66
No insurance rate in state	11 281	8.178	3.771	1.292	30.98
HMO penetration rate in state	11 278	0.232	0.112	0.001	0.641
Works in for-profit, primary facility	10 372	0.292	0.455	0	1
Medicare Advantage Part B payment rate	11 281	217.7	67.71	37.17	417.1
Medicare Advantage Part A payment rate	11 281	247.6	77.84	42.9	481.5
% Medicare Advantage penetration rate	11 281	11.29	6.05	0.156	43.55
Number of Medicaid eligible in HRR	11 281	33 285	45 724	1030	244 026

Abbreviations: Obs., number of observations; HMO, health maintenance organization; HRR, hospital referral region; Max., maximum; Min., minimum; Std. Dev., standard deviation.

pretreatment trends. Unfortunately, in this case we only have one year of pretreatment data, so we cannot compare the trends before, nor can we even provide a graph for qualitative inference on the trends, given the single year of pretreatment data. We include as potential controls anesthesiologists from any state except for Colorado and Kentucky. This then allows for those in states that were opt-out states in both waves of the survey and those in states that were not opt-out states in either wave of the survey. However, ultimately the focus is on California compared to other states, and this is a necessary limitation of the study.

Given our inability to compare pretreatment trends, and our potential concerns about how different the health labor markets in California may be, we use the Coarsened Exact Matching (CEM) estimator. The CEM estimator matches in the multidimensional variable space, unlike other matching estimators such as propensity score matching. We use the CEM estimator to first remove anesthesiologists that do not have matches. We match on three categories: health market characteristics (such as population and income), individual characteristics (such as the anesthesiologist gender and age), and most importantly, the baseline outcome. For the baseline outcome, we take the average in 2007 for

each health market and include this average as a covariate. The CEM methodology removes both California anesthesiologists for whom we cannot find similar non-California anesthesiologists and non-California anesthesiologists that do not match to any of the California anesthesiologists in the data. So, for example, in creating the matches for an anesthesiologist in California that is female, from an urban area, and from an HRR that in 2007 had anesthesiologists working on average 70 hours and average age of 50 and average local income of 45 000 and log population of 14, we would match all to non-California anesthesiologists that are also female, also from an urban area, and also from an HRR that in 2007 had anesthesiologists working on average between 65.4 and 83.6 hours, average age between 45 and 63, average local income between 27 000 and 50 000, and log population between 13.2 and 14.7. This matching ensures that control anesthesiologists are similar to the treated anesthesiologists, which makes the parallel assumption more likely to hold. The CEM methodology also produces regression weights that reflect the uncovering of a hidden block-random experiment and improve the quasi-experimental assumptions. We use these weights in the difference-in-difference regression. Standard errors are clustered at the state level, and

TABLE 3 Outcome variables and moments

Outcome	Match rate		CEM-adjusted 2007 mean		Raw 2007 mean	
	CA	Non-CA	CA	Non-CA	CA	Non-CA
1. Distribution of time on services						
% time in preoperative evaluation	1.00	0.64	7.96 (9.38)	9.27 (8.43)	7.96 (9.38)	11.16 (11.32)**
% time in intraoperative care	1.00	0.59	70.06 (23.69)	65.05 (22.23)	70.06 (23.69)	65.64 (23.07)**
% time in postoperative care	1.00	0.63	6.07 (6.14)	5.99 (4.66)	6.05 (6.13)	7.46 (6.55)**
% time in critical care	0.89	0.63	1.76 (8.89)	1.85 (9.76)	2.62 (12.06)	1.98 (9.39)**
% time in chronic pain care	1.00	0.64	2.14 (11.81)	2.92 (13.77) [†]	2.14 (11.81)	2.87 (13.12)*
% time in acute pain management	1.00	0.60	1.87 (4.03)	2 (4.34)	1.87 (4.02)	2.96 (6.02)**
% time in labor and delivery	1.00	0.61	6.69 (11.71)	6.58 (10.42)	7.59 (13.24)	7.4 (11.79)
2. Distribution of time on techniques						
% time on monitored anesthesia care	1.00	0.62	14.92 (15.01)	13.73 (13.12)	14.92 (15.01)	15.52 (15.56)
% time on general anesthesia	0.91	0.56	69.4 (20.81)	68.7 (22.18) [†]	69.4 (20.81)	66.82 (22.35)*
% time on regional anesthesia	1.00	0.60	9.32 (10.97)	8.92 (11.63)	9.31 (10.96)	11.37 (14.08)**
% time on labor epidurals	0.91	0.59	5.63 (10.33)	4.86 (10.58)	6.36 (11.47)	6.3 (10.55)
3. Workload						
Hours worked per week	0.96	0.59	56.04 (15.88)	56.64 (14.7)	56.09 (15.89)	56.54 (14.63)
Hours at work not providing services because of delays	0.77	0.63	6.57 (7.1)	5.99 (7.2)	6.92 (8.15)	5.8 (6.85)**
Typical clinical workload	0.99	0.62	46.14 (15.33)	48.53 (15.04)**	46.08 (15.53)	48.71 (14.05)**
% of clinical time spent on inpatient care	1.00	0.62	53.02 (25.92)	52.14 (26.99)**	53.04 (25.89)	49.16 (26.16)**
% of clinical time spent on outpatient care	1.00	0.62	46.98 (25.92)	47.86 (26.98)**	46.96 (25.89)	50.84 (26.16)**
Increased hours since 3 years ago	0.91	0.59	0.44 (0.5)	0.42 (0.49)	0.44 (0.5)	0.56 (0.5)**
4. Supervision						
% of cases supervising residents	1.00	0.34	74.41 (38.96)	78.77 (34.01)	76.62 (37.68)	43.23 (41.04)**
% of cases directing CRNA	1.00	0.46	9.34 (21.07)	13.67 (26.24) [†]	9.34 (21.07)	38.12 (36.32)**
Annual reported earnings	0.99	0.54	380 502 (130 018)	396 388 (126 833)**	380 502 (130 017)	409 232 (149 477)**

Note: Standard deviations in parentheses. CA is California. Non-CA is all other states. ** $P < .01$; * $P < .05$; [†] $P < .1$ for the difference between California anesthesiologists and non-California anesthesiologists after multiple hypothesis correction using Benjamini-Hochberg's approach.

given the several outcomes tested, multiple hypothesis correction is done using Benjamini-Hochberg's approach. The methods are described in more detail in the Appendix S1.

3 | RESULTS

Table 5 presents the results of the CEM difference-in-difference model. In an online Appendix S1, we provide a description of and the results for a cross-sectional regression model and a non-matched difference-in-difference model, which can be used for comparison.

We first look at the first set of outcomes, how anesthesiologists change the distribution of time on various services. We find shifts in the services provided as a result of opt-out. Specifically, we find an increase of 5.6 percentage points for time spent in intraoperative care. This is a sizeable increase from the 2007 treatment mean of 70 percent. This occurs along a decrease in time in acute pain management (0.672 percentage points from the 2007 treatment base of 1.87 percent). This suggests anesthesiologists shift from tasks performed outside of the OR to tasks that are performed within the OR. As shown in the online appendix, if we look at either the cross-sectional or the non-CEM difference-in-difference models, the results, although different, typically do not

TABLE 4 Year of Medicare opt-out

Year	State
2001	Iowa (December)
2002	Nebraska (February), Idaho (March), Minnesota (April), New Hampshire (June), New Mexico (November)
2003	Kansas (March), North Dakota (October), Washington (October), Alaska (October), Oregon (December)
2004	Montana (January)
2005	South Dakota (March), Wisconsin (June)
2009	California (July)
2010	Colorado (September) ^a
2012	Kentucky (April)

^aLimited to critical access hospitals and specified rural hospitals.

Source: Sun et al¹³

TABLE 5 CEM regression results of the effect of opt-out on the outcomes of interest

	Outcome	Coef.	SE
1. Distribution of time on services	% time in preoperative evaluation	0.584	(0.671)
	% time in intraoperative care	5.663**	(1.369)
	% time in postoperative care	-0.858	(0.505)
	% time in critical care	0.372	(0.517)
	% time in chronic pain care	-0.462	(0.902)
	% time in acute pain management	-0.672*	(0.229)
	% time in labor and delivery	-0.210	(1.056)
2. Distribution of time on techniques	% time on monitored anesthesia care	-2.096†	(0.849)
	% time on general anesthesia	2.094	(1.134)
	% time on regional anesthesia	-0.161	(0.463)
	% time on labor epidurals	-0.0403	(0.504)
3. Workload	Hours worked per week	-0.168	(0.534)
	Hours at work not providing services because of staffing or delays	-0.272	(0.756)
	Typical clinical workload	-2.171	(1.067)
	% of clinical time spent on inpatient care	-3.294	(1.580)
	% of clinical time spent on outpatient care	3.165	(1.557)
	Increased hours since 3 y ago	-0.0829	(0.0448)
4. Supervision	% of cases supervising residents	7.077†	(3.013)
	% of cases directing CRNA	-2.682	(2.424)
5. Income	Annual reported earnings	-4070	(12 980)

Abbreviations: Coef., coefficient; SE, standard error.

Each cell comes from a separate regression. The regressions include all control variables enumerated in Table 3 as well as year, state, and hospital referral region fixed effects. ** $P < .01$; * $P < .05$, † $P < .1$ after multiple hypothesis correction using Benjamini-Hochberg's approach.

change signs, including for the three significant cases for the CEM model.

We next examine the second group of outcomes that look at how anesthesiologists change the distribution of techniques. We find a 2.1-percentage point decrease in time on monitored anesthesia care from a 2007 treatment base of 14.9 percent, almost exactly traded

off by a 2.1-percentage point increase in time on general anesthesia, although the latter is not statistically significant at conventional levels after multiple hypothesis correction. The trade-off is consistent with the narrative around the change in the distribution of services, as the anesthesiologists are providing more anesthesia services to patients in the OR and most general anesthetics are performed

within the OR setting, as well as outpatient general anesthetics which has the potential to generate more revenue as these tend to be elective cases for patients with private insurance or Medicare.

The next group of outcomes is concerning workload. We find no change in hours worked as a result of the opt-out. Anesthesiologists work the same number of hours (we can reject at the 5 percent level decrease of more than 1.2 hours). There is also no change in the number of hours not providing services due to delays or staffing issues, suggesting no change in overall unused time. However, there is a decrease in typical clinical workload of 2 hours and a smaller proportion of anesthesiologists that say their number of hours have increased over the previous three years, so there is some limited evidence of effect on workload. We also find an almost one-for-one shift between clinical time spent on inpatient and outpatient care, with a 3-percentage point increase in outpatient care although these estimates are not statistically significant at conventional levels after multiple hypothesis correction. Given that there has been a major shift in the proportion of patients who are inpatients receiving surgical services to the outpatient setting, this is not a surprising finding.

We next look at the proportion of cases spent supervising. We find a relatively substantial increase in the proportion of time spent supervising residents, but surprisingly, no change at all in the percentage of cases spent supervising CRNAs.

Finally, we see no significant change in the earnings of anesthesiologists. We had no hypothesis that there would have been a change in earnings, especially with no change in overall workload, but we confirm that in the findings.

4 | DISCUSSION

Using two surveys of anesthesiologists, we examine the effects on the work environment of anesthesiologists of opting-out of Medicare requirements for how certified registered nurse anesthetists can practice and bill for cases specifically within the state of California.

The typical practice in a non-opt-out state would be that anesthesiologists supervise both CRNAs and residents. Anesthesiologists participate in the preoperative evaluation and other key portions of the case but have the flexibility to leave elements of the intraoperative care largely in the hands of the CRNAs and/or residents while the anesthesiologists attend to other preoperative and postoperative duties. Anesthesiologist work patterns have shifted from tasks performed outside of the OR to tasks that are performed within the OR. This is also associated with a 2.1-percentage point decrease in time on monitored anesthesia care (MAC).

With the opt-out, anesthesiologists are able to spend more time in intraoperative care and corresponding less time in acute pain management (which happens outside of the operating room, which they otherwise would be able to attend to with more CRNA support). This is consistent with the narrative around the change in the distribution of services, as the anesthesiologists are providing more anesthesia services in the OR. Because most general anesthetics

are performed within the OR setting, there appears to be no change in hours worked as a result of the opt-out. Additionally, many MAC cases are performed outside of the OR in settings such as GI laboratories and other interventional settings and it would not be uncommon for these cases to be assigned to unsupervised CRNAs.

On the other hand, we see no evidence for change in the overall workload of anesthesiologists. There is no change in hours worked as a result of the opt-out and no change in the number of hours not providing services due to delays or staffing issues, suggesting no change in overall unused time. We do find a decrease in the typical clinical workload of 2 hours and a smaller proportion of anesthesiologists that say their number of hours have increased over the previous three years, as well as an almost one-for-one shift between clinical time spent on inpatient and outpatient care, with a 3-percentage point increase in outpatient care. This may be due to slackened demand given the more independent practice of CRNAs. But again, these results related to shifts in inpatient and outpatient clinical time were not statistically significant after correcting for multiple hypothesis testing.

There is a substantial increase in the proportion of time spent supervising residents, but surprisingly no change at all in the percentage of cases spent supervising CRNAs. This may be impacted by the change in reimbursement for Medicare cases that occurred in 2010 (ie, Medicare Teaching Rules), which established that a teaching anesthesiologist may recoup 100 percent from each of two rooms where a resident is supervised in each room. This is to be contrasted with the 50:50 split of reimbursement when the anesthesiologist supervises two rooms with a CRNA in each room. It may also reflect that, with more CRNAs able to practice independently, anesthesiologists have greater opportunity to teach and supervise residents. It is less clear why there would be a trade-off from inpatient to outpatient care. Outpatient care does tend to have higher reimbursement rates, so this may represent greater flexibility in working environments allowing anesthesiologists to pursue higher reimbursement cases to a slight degree.

Finally, we note that, despite statistical significance, the magnitude of many of our results is relatively modest. So, despite changes in regulatory requirements, anesthesia practice in the opt-out state seems to not be profoundly impacted. Although there is little empirical evidence to explain these modest effects, we propose a number of hypotheses. First, it may be that state regulatory requirements actually have limited effect on the day-to-day practice of CRNAs. For example, in the non-opt-out state of Pennsylvania, CRNAs who are practicing in care teams without an anesthesiologist must be supervised by the operating physician or if working in teams without a physician present must have electronic backup communication with a physician of their choice, which may or may not be an anesthesiologist. If Pennsylvania opted out, the only change would be that CRNAs practicing in care teams without anesthesiologist would no longer require supervision from the operating surgeon and would no longer be required to have de-facto electronic communication with a physician of their choice. The likely outcome would be that of limited impact on the practice of this group of CRNAs. Second, employment

is likely relatively “sticky,” meaning it is very difficult to change workforce composition and practice in a relatively small period of time. It is unlikely that a hospital would immediately and meaningfully move away from anesthesiologists and their employment contracts simply because of opt-out. Opt-out regulations require active implementation by the participants in the health care system. After a state decides to opt-out, individual hospitals would need to intentionally change their policies around the practice of anesthesia. However, medical staffs often have significant control over institutional policy decisions and as such, they may be unwilling to make significant changes in response to state opt-out decisions.

Our study has some important limitations. First, only California changed opt-out status during the course of our study. Therefore, the effect of opt-out is driven by the experience of a single, albeit large and diverse state. Second, California has some of the least restrictive scope-of-practice (SOP) regulations in the United States. This may explain large differences across California and non-California states in terms of time spent directing CRNAs in the raw data. However, the differences are much smaller when CEM weights are applied, and the inclusion of HRR fixed effects should account for this issue as SOP does not change over time. Third, all of the outcome measures are self-reported and our estimates may include the associated measurement bias. However, survey data collection approach allowed us to collect national data on anesthesiologist workforce.

Overall, our findings suggest that anesthesiologists have small but real responses to California opting-out of the physician supervision requirement for CRNAs, as they do more work in the intraoperative setting and less work outside of the operating room.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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REFERENCES

1. Dall TM, Gallo PD, Chakrabarti R, West T, Semilla AP, Storm MV. An aging population and growing disease burden will require a large and specialized health care workforce by 2025. *Health Aff.* 2013;32(11):2013-2020.
2. Douthitt N, Kiv S, Dwolatzky T, Biswas S. Exposing some important barriers to health care access in the rural USA. *Public Health.* 2015;129(6):611-620.
3. Office of Rural Health Policy: Rural Guide to Health Professions Funding. U.S. Department of Health and Human Services. Published May 2012. <https://www.hrsa.gov/ruralhealth/pdf/ruralhealthprofessionsguidance.pdf>. Accessed May 15, 2017.
4. Liao CJ, Quraishi JA, Jordan LM. Geographical imbalance of anesthesia providers and its impact on the uninsured and vulnerable populations. *Nurs Econ.* 2015;33(5):263.
5. Negrusa B, Hogan PF, Warner JT, Schroeder CH, Pang B. Scope of practice laws and anesthesia complications: no measurable impact of certified registered nurse anesthetist expanded scope of practice on anesthesia-related complications. *Med Care.* 2016;54(10):913-920.
6. Clarification of the Interpretive Guidelines for the Anesthesia Services Condition of Participation. Centers for Medicare & Medicaid Services. Pub. 100-07 State Operations Transmittal 59. Published May 2010. <https://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R59SOMA.pdf>. Accessed May 15, 2017.
7. Spotlight. Centers for Medicare & Medicaid Services. Published February 2017. <https://www.cms.gov/Regulations-and-Guidance/Legislation/CFCsAndCoPs/Spotlight.html>. Accessed March 23, 2017.
8. Opt-out. American Society of Anesthesiologists. <http://www.asahq.org/~media/legacy/for%20members/about%20asa/governance/2013%20governance%20year/aa2013boddmtopic%201%20opt%20out.pdf>. Accessed March 23, 2017.
9. Downey PM. Achieving the opt out for Medicare physician supervision for nurse anesthetists. *AANA J.* 2010;78(2):96-100.
10. Dulisse B, Cromwell J. No harm found when nurse anesthetists work without supervision by physicians. *Health Aff.* 2010;29(8):1469-1475.
11. Hogan P, Seifert R, Moore C, Simonson B. Cost effectiveness analysis of anesthesia providers. *Nurs Econ.* 2010;28(3):159-169.
12. Sun EC, Dexter F, Miller TR, Baker LC. "Opt Out" and access to anesthesia care for elective and urgent surgeries among U.S. medicare beneficiaries. *Anesthesiology.* 2017;126(3):461-471.
13. Sun E, Dexter F, Miller TR. The effect of "opt-out" regulation on access to surgical care for urgent cases in the United States: evidence from the national inpatient sample. *Anesth Analg.* 2016;122(6):1983-1991.
14. Schneider JE, Ohsfeldt R, Li P, Miller TR, Scheibling C. Assessing the impact of state "opt-out" policy on access to and costs of surgeries and other procedures requiring anesthesia services. *Health Econ Rev.* 2017;7(1):10.
15. Martzolf GR, Baird M, Cohen CC, Koirala N. Relationship between state policy and anesthesia provider supply in rural communities. *Med Care.* 2019;57(5):341-347.
16. Baird M, Daugherty L, Kumar KB, Arifkhanova A. The Anesthesiologist Workforce in 2013. RAND Report. 2017;RR-650-ASAI.
17. Baird M, Daugherty L, Kumar KB, Arifkhanova A. Regional and gender differences and trends in the anesthesiologist workforce. *J Am Soc Anesthesiol.* 2015;123(5):997-1012.
18. Daugherty L, Fonseca R, Kumar KB, Michaud PA. *An Analysis of the Labor Markets for Anesthesiology*. Santa Monica, CA: RAND Corporation; 2010:TR-688.

19. Iacus SM, King G, Porro G, Katz JN. Causal inference without balance checking: coarsened exact matching. *Polit Anal*. 2012;20:1-24.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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