

Impact of COVID-19 Pandemic on Certified Registered Nurse Anesthetist Practice

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The coronavirus disease 2019 (COVID-19) pandemic prompted profound shifts in the delivery of critical healthcare services. A mixed-methods study was conducted to explore the impact of the pandemic on Certified Registered Nurse Anesthetist (CRNA) practice. The quantitative component involved a survey of CRNAs during the initial period of the pandemic to determine changes in practice and any relationship to removal of state and federal barriers. Approximately 16% of 2,202 responding CRNAs reported practice expansion beyond their normal responsibilities, primarily outside the operating room and involving tra-

cheal intubation, ventilator management, arterial line placement, and central line placement. CRNAs were more likely to experience an expansion of practice in states affected by removal of regulatory barriers. However, respondents also reported missed opportunities to use the full expertise of CRNAs because of state and institutional restrictions. Findings from the qualitative component of this study are reported in a separate article.

Keywords: Anesthesiology, COVID-19, nurse anesthetist, pandemic, scope of practice.

Major shifts in the delivery of critical healthcare services occurred as a result of the coronavirus disease 2019 (COVID-19) pandemic, such as suspension of elective surgical procedures, increased intensive care unit (ICU) utilization, and interruption in primary care services. The US president declared a national public health emergency in March 2020,¹ and a number of regulatory waivers and new rules were implemented to allow for greater flexibility in addressing healthcare needs related to the pandemic.²

Certified Registered Nurse Anesthetists (CRNAs) have long advocated for the ability to practice to the full scope of their education and training in all settings. The landmark 2010 Institute of Medicine report, *The Future of Nursing*, endorsed this position, advocating for removal of scope of practice (SOP) barriers for all advanced practice registered nurses (APRNs).³ Evidence has shown that removal of practice barriers for CRNAs and other APRNs improves availability and cost-efficiency of healthcare services,⁴⁻⁷ with quality outcomes similar to those of their physician counterparts.⁸⁻¹¹ An important federal regulatory change that occurred because of the pandemic was removal of the physician supervision requirement of CRNAs.² In addition, 20 state governors issued executive

orders lifting various restrictions on CRNAs' and other APRNs' practice.

- **State Regulation.** Each state has varying levels of statutes and regulations affecting CRNA practice. These levels include physician supervision (Supervision-Level; oversight of CRNAs, the most restrictive regulation, which requires physician involvement in CRNA practice); physician direction or collaboration (Direction/Collaboration-Level; a less restrictive form of physician involvement that allows greater degree of CRNA autonomy); and states with no statutes or regulations restricting CRNA practice, allowing CRNAs to practice to the full scope of their licensure and certification.

The potential impact of a state executive order removing barriers to CRNA practice depends on this preexisting level of restriction. Supervision-Level states, with the most severe restrictions, would potentially demonstrate the greatest movement toward full CRNA SOP when these restrictions were removed or reduced. States with Direction/Collaboration-Level requirements may also experience some expansion in clinical activities approaching full SOP if these requirements are removed; however, since these rules are less restrictive than supervision, the impact is likely reduced compared with that potentially experienced in Supervision-Level states. Finally, states

with no state regulatory requirements would presumably not be affected by a state executive order.

• **Federal Regulation.** Removal of the requirement of physician supervision of CRNAs in the Medicare Part A Conditions of Participation was poised to occur in 2001 but was delayed and ultimately retained with the addition of an opt-out process for state governors. Currently 19 states and the District of Columbia have opted out of the federal requirement for physician supervision of nurse anesthetists. The Centers for Medicare and Medicaid Services (CMS) waived the CRNA supervision requirement in the Medicare Part A Conditions of Participation during the pandemic, which removed federal barriers to CRNA practice in facilities in states that had not previously opted out of this requirement. Because state regulations concerning CRNA practice are varied, the impact of removing this federal requirement differs in each state depending on state statute and regulatory requirements. The presence of the federal supervision requirement is redundant where state statutes or regulations also require supervision, meaning its removal does not affect the overall environment with respect to practice barriers. However, without regulatory practice barriers in state statutes and regulations, removing the federal requirement effectively gives the state the equivalent of opt-out status.

In an effort to better understand the impact of the COVID-19 pandemic on CRNA practice, we conducted a survey as part of a mixed-methods investigation. The unique circumstances of the pandemic allowed us to collect information related to barrier removal that would otherwise have been unavailable. The specific aim of this study was to describe and quantify changes to CRNA practice as a result of state and federal regulatory modifications in response to the pandemic. It was our hypothesis that Supervision-Level states would be most likely to experience the greatest movement toward full CRNA SOP with removal of barriers to practice.

Materials and Methods

Institutional review board approval for this exempt study was provided by Webster University, St Louis, Missouri. An electronic survey was sent to 44,100 CRNAs with current email addresses in the American Association of Nurse Anesthesiology (AANA) database to assess changes in clinical responsibilities and practice due to COVID-19–related policy and regulatory changes. CRNAs performing clinical duties during the pandemic were targeted for inclusion.

• **Survey Tool.** The survey was powered by Qualtrics Survey Software (Qualtrics). The survey instrument was designed by the research team, which included individuals with experience in both survey development and clinical practice. Branching logic was used to assess practice issues by state for respondents who worked in a single state, and those who worked in an additional state as well, during the pandemic. Survey content included

participant demographics, facility-related characteristics (state, facility type, and location [urban, suburban, rural]), areas of practice (operating room, ICU, COVID team), role during the pandemic (traditional CRNA, APRN, ICU RN), and clinical practice and other associated activities with and without supervision. Perceived change in access and quality of patient care was also assessed. The tool was reviewed by a CRNA expert in survey research and was revised and tested by the research team. A panel of 5 CRNAs with expertise in survey research and clinical practice were then recruited to evaluate the survey to establish face and content validity before deployment.

The survey assessed 11 clinical practice items to determine if a change in performance status took place after the start of the pandemic. These items were stratified by supervision status and respondents were given 4 options for each item: (1) there was no change and they still did not perform the given item, (2) there was no change but they already performed the item in the operating room, (3) they now performed the item in the operating room, and (4) they now performed the task outside the operating room. *Expanded practice* is defined as performing a task without supervision if such task was previously only performed supervised, or performing a task outside the operating room if such task previously was only performed in the operating room setting.

The reliability of expanded practice vs nonexpanded practice items was calculated as Cronbach $\alpha=0.84$, demonstrating good reliability. Respondents were also asked about pandemic work experience related to a variety of settings and responsibilities, including the Emergency Department, inpatient COVID unit, ICU, COVID team, airway intubation team, and operating room. A summary item capturing any type of nonoperating room experience was included in the analysis to assess the expanded use of CRNAs in nonoperating room settings. Another measure based on these work experience items assessed whether CRNAs worked in any capacity taking care of patients with COVID-19.

• **Data Collection and Analysis.** The survey was active July 15 to September 1, 2020. An email with a cover letter describing the purpose of the survey and its importance, and the link to the survey, was provided. Two reminders were sent to encourage completion of the survey.

Frequency distributions were calculated for demographic and practice characteristics. For the primary analyses, descriptive statistics were compiled from the primary state (for those practicing in multiple states) combined with results from those practicing in a single state. To analyze the impact of state regulation on CRNA practice, states were grouped by their level of state regulation before the pandemic, their federal supervision opt-out status, and the corresponding impact of executive orders removing barriers to CRNA practice (Table

Executive order status	State CRNA regulatory requirements			
	No Supervision/ Direction/Collaboration	Direction/ Collaboration	Supervision	
No state executive order	Alaska ^a	District of Columbia	Arkansas	
	Arizona ^a	Georgia	Florida	
	California ^a	Illinois	Mississippi	
	Colorado ^a	Indiana	Missouri	
	Delaware ^b	Minnesota ^a	Ohio	
	Hawaii ^b	Nebraska ^a	Rhode Island	
	Idaho ^a	Nevada	South Carolina	
	Iowa ^a	North Carolina	Utah	
	Montana ^a	Oklahoma ^a	Virginia	
	New Hampshire ^a	South Dakota ^a	Wyoming	
	New Mexico ^a			
	North Dakota ^a			
	Oregon ^a			
	Texas ^b			
	Vermont ^b			
	Washington ^a			
	Tennessee ^b			
	State executive order		Kansas ^{a,b}	Alabama ^c
			Kentucky ^{a,b}	Louisiana ^c
		Wisconsin ^{a,b}	New Jersey ^c	
			Pennsylvania ^c	
		Connecticut ^c	Maine ^c	
		Massachusetts ^c	Michigan ^c	
		Maryland ^c	New York ^c	
			West Virginia ^c	

Table 1. Impact of State and Federal Executive Orders

Abbreviation: CRNA, Certified Registered Nurse Anesthetist.

^aOpt-out states.

^bMinor Impact (removal of state restrictions or federal restrictions in states with no other regulations).

^cMajor Impact (removal of state and federal restrictions).

1). A *Major Impact state* was defined as a nonopt-out state with Supervision- or Direction/Collaboration-Level regulation that experienced a state executive order to remove regulatory barriers. A *Minor Impact state* was one that was affected either by a state executive order or the federal executive order removing the supervision requirement, but not both. These included opt-out states that still had a state requirement for direction or collaboration, and also those that initially had no state-level practice restrictions but were still subject to the CMS supervision requirement. All other states were considered *No Impact states* (see Table 1).

Multivariate logistic regression was used to explore the effect of regulatory impact (Major or Minor Impact state) on these 3 outcomes: (1) change in CRNA practice (expanded or not expanded), (2) expansion of CRNA work outside the operating room setting (yes or no), and (3) CRNA activities involving care for patients with COVID-19 (yes or no). Models were adjusted for practice setting characteristics that were known or expected to have an impact on CRNA practice. Inpatient setting is controlled since this is where most acute COVID-19-related patient

care takes place. Also, CRNAs practicing in rural locations have been found to have greater SOP than those in urban and suburban areas, suggesting reduced impact of barrier removal in those areas.¹² It is reasonable to believe that facilities may have had variable responses to COVID-19 based not just on regulatory changes but also the actual burden of COVID-19 disease. Therefore, the level of state COVID-19 disease burden during the period of study was controlled for in the analyses. This measure was calculated using the total cases per 1,000 population during the time from the onset of the pandemic in January 2020 until August 27, 2020, when the survey closed. Data on COVID-19 burden were sourced from the time-series data file of The Johns Hopkins University Coronavirus Resource Center.¹³ Finally, state and federal pre-COVID-19 regulatory status was controlled since the potential for change in practice attributable to removal of the regulatory barriers depends on the prior level of restrictions. Significance was determined based on *P* value <.05.

Results

Although it is unknown how many CRNAs continued

clinical practice during this time, in a previous survey on COVID-19–related workforce issues, approximately 80% indicated they did work during this time,¹⁴ leaving an estimated number of 35,280 potential participants. Of the 2,202 CRNAs who responded to the survey, 2,097 affirmed they practiced during the early months of the pandemic. These data were retained for analyses, for an estimated 6% participation. Survey participants were from all 50 states and Washington, DC, and 6.3% reported working in at least one additional state during the pandemic period.

Primary results describe clinical responsibilities of CRNAs practicing in a single state or the original state (if respondent practiced in >1 state). Most (84%) practiced exclusively in a traditional CRNA role, and the most common settings were the operating room (91.4%), ICU (18.2%), or Emergency Department (12.7%; Table 2). More than one-fourth of participants reported working in a COVID-associated setting, primarily on a COVID team (16%) or inpatient COVID unit (9.5%). About 16% of respondents reported an expansion of practice during the COVID-19 pandemic (Table 3). Practice expansion most commonly occurred outside the operating room, particularly in the following areas: tracheal intubation (n=129), ventilator management (n=82), arterial line placement (n=76), and central line placement (n=49).

As detailed in Table 4, the largest factor predicting CRNA expansion of practice during the pandemic was practicing in a Major Impact state vs No Impact states (odds ratio [OR]=1.83, $P=.001$) after adjusting for practice characteristics and state COVID-19 burden. No significant effect was observed for pre-COVID-19 state regulatory environment or federal Opt-out status. In a similar adjusted model, CRNAs were significantly more likely to expand their work outside the operating room setting in Major Impact states (OR=2.37, $P<.0001$) and in states that held federal opt-out status (OR=1.52, $P<.0001$). Similarly, CRNAs in Major Impact states were more likely to report they cared for patients with COVID-19 (OR=2.55, $P<.0001$). These CRNAs in Major Impact states were significantly less likely to care for patients with COVID-19 in states with Direction/Collaboration (OR=0.70, $P=.03$) or Supervision (OR=0.66, $P=.03$) state regulatory environments or in Minor Impact states (OR=0.62, $P=.01$) in adjusted models. CRNAs in rural areas were significantly less likely to experience expanded clinical practice (OR=0.68, $P=.03$) but were more likely to work outside the operating room (OR=1.40, $P=.004$).

Discussion

During the COVID-19 pandemic, CRNAs' expertise in conducting rapid multiorgan system assessments, airway management, care of critically ill patients, team coordination, and resource allocation has been vital to supporting patients. These critical activities have resulted in CRNAs'

Characteristic	No. (%)
Practiced in multiple states	
Yes	130 (6.3)
No	1,938 (93.7)
Years in practice	
0-5	327 (15.7)
6-10	336 (16.1)
11-15	374 (18.0)
16-20	276 (13.3)
>20	770 (37.0)
Highest degree	
Bachelor's	236 (11.4)
Master's	1,536 (74.2)
Doctoral	298 (14.4)
Inpatient setting	
Yes	1,597 (77.2)
No	471 (22.8)
Rural setting	
Yes	409 (19.8)
No	1,659 (80.2)
Practice areas	
Operating room	1,891 (91.4)
Emergency Department	263 (12.7)
Intensive care unit	377 (18.2)
COVID-19 team	330 (16.0)
Inpatient COVID-19 unit	196 (9.5)
Other activity	278 (13.4)
Role	
CRNA only	1,737 (84.0)
Other role (eg, other APRN, RN)	331 (16.0)
CRNA practice changes	
Practice expansion	
Yes	262 (15.6)
No	1,416 (84.4)
Practiced outside operating room	
Yes	858 (41.5)
No	1,210 (58.5)
Cared for patients with COVID-19	
Yes	463 (22.4)
No	1,605 (77.6)

Table 2. Demographic Characteristics of Sample (N=2,097)^a

Abbreviations: APRN, advanced practice registered nurse; COVID-19, coronavirus disease 2019; CRNA, Certified Registered Nurse Anesthetist; RN, registered nurse.

^aSome respondents did not reply to all survey items, and percentages are based on No. of respondents to that particular item. Some totals do not equal 100% because of rounding or because multiple answers were allowed.

utilization to their full SOP. Indeed, CRNAs were tasked to assume responsibilities different from their traditional anesthesia roles, such as managing patients on ventilators in ICUs, providing critical care services in operating and emergency rooms, and triaging patients, thereby facilitating high-quality healthcare during a time of acute and profound need. We found that CRNAs often provided their expertise in areas of need throughout the hospital,

Practice	Expanded		Stayed the same	
	In operating room, No. (%)	Outside operating room, No. (%)	Already perform, No. (%)	Did not perform, No. (%)
Central line placement	7 (0.5)	49 (3.2)	348 (22.5)	1,145 (74.0)
Arterial line placement	13 (0.8)	76 (4.9)	990 (63.8)	472 (30.4)
Chest tube placement	3 (0.2)	6 (0.4)	47 (3.1)	1,461 (96.3)
Tracheal intubation	16 (1.0)	129 (8.2)	1,270 (81.1)	152 (9.7)
Induction from anesthesia	34 (2.1)	34 (2.1)	1,409 (88.6)	114 (7.7)
Emergence from anesthesia	30 (1.9)	19 (1.2)	1,465 (90.8)	100 (6.2)
Neuraxial blocks	5 (0.3)	12 (0.8)	821 (52.7)	720 (46.2)
Peripheral nerve blocks	9 (0.6)	15 (1.0)	549 (35.6)	968 (62.8)
Ventilator management	14 (0.9)	82 (5.3)	1,124 (72.1)	340 (21.8)
Bronchoscopy	12 (0.8)	16 (1.1)	286 (18.7)	1,214 (79.5)
Respiratory treatments (nebulized, CPAP, BPAP)	15 (1.0)	51 (3.3)	658 (42.9)	810 (52.8)

Table 3. Change in CRNA Practice

Abbreviations: BPAP, bilevel positive airway pressure; CPAP, continuous positive airway pressure; CRNA, Certified Registered Nurse Anesthetist.

Parameter	Experienced expanded practice (N=1,629)		Worked outside operating room (N=1,977)		Cared for patients with COVID-19 (N=1,952)	
	OR	P	OR	P	OR	P
Practice setting characteristics						
COVID-19 case rate (per 1,000 population as of August 27)	1.01	0.5547	1.00	0.8955	1.0	0.5742
Inpatient hospital (vs all others)	3.97	<.0001	2.25	<.0001	8.86	<.0001
Rural (vs nonrural)	0.68	0.0349	1.40	0.0040	0.75	0.0428
Pre-COVID-19 state regulatory environment						
Supervision (vs none)	1.01	0.9732	0.80	0.1674	0.66	0.0335
Direction/Collaboration (vs none)	1.26	0.2845	0.94	0.6348	0.70	0.0246
Federal regulations						
Opted-out of CMS supervision requirement (vs has not)	0.77	0.2247	1.52	0.0019	1.20	0.2720
Impact of state and federal executive orders						
Major (vs No Impact)	1.83	0.0011	2.37	<.0001	2.55	<.0001
Minor (vs No Impact)	0.74	0.2138	0.77	0.0667	0.62	0.0111

Table 4. Logistic Regression of Practice Changes on State Policy Measures

Abbreviation: COVID-19, coronavirus disease 2019.

P<.05 is significant.

for example, working with physicians and nurses to safely prone intubated patients while preventing injury or inadvertent extubation. This sharing of specialized knowledge proved valuable and can serve as a model for cross-service teaching and future collaboration. Research has demonstrated that improved teamwork and esprit de corps elevates hospital culture and staff morale.¹⁵

In our assessment, the greatest factor predicting CRNA expansion of practice was practicing in a Major Impact state (OR=1.83, P<.0001), meaning the odds were increased by 83% that CRNAs practicing in a Major Impact state would experience an expansion of practice.

Clearly, CRNAs were significantly more likely to expand their work outside the operating room in states affected by executive orders, including the removal of both state and federal barriers to practice. Major Impact states imposed the most restrictive regulations before COVID-19; therefore, removal of these barriers had the greatest impact on practice. Practice expansion most commonly occurred outside the operating room and involved tracheal intubations, ventilator management, and insertion of arterial and central lines. All techniques are well within the scope of training and practice of the CRNA. On the other hand, CRNAs in Minor Impact states dem-

onstrated no significant change in practice or working outside the operating room, and they were significantly less likely to care for patients with COVID-19 compared with No Impact states (not affected by regulatory waiver/executive orders).

Similar to Minor Impact states, CRNAs who practiced in rural settings were significantly less likely to care for patients with COVID-19, but also 32% less likely to experience expanded clinical practice (OR=0.68, $P<.03$). Conversely, these CRNAs were 40% more likely to work outside the operating room conducting tasks that they normally performed in the operating room (OR=1.4, $P<.004$), again to facilitate care of patients with COVID-19 in the ICUs. This finding again suggests that in settings where CRNAs were already practicing to their fullest SOP, such as in rural settings and opt-out states, they were more likely to be utilized in a broader capacity outside the operating room.

After controlling for pre-COVID-19 state and federal regulations, the impact of executive orders became apparent. In states that experienced a major impact due to executive orders (including the removal of both state and federal requirements), CRNAs were significantly more likely to experience expanded clinical practice (OR=1.83, $P<.0001$), work outside the operating room (OR=2.37, $P<.0001$), and care for patients with COVID-19 (OR=2.37, $P<.0001$). Our findings clearly demonstrate that removal of barriers to practice and the expansion of the responsibilities of the CRNA to full SOP led to contributions in the care of patients with COVID-19 in much-needed areas. However, the overall low rate of practice expansion of 15.3% suggests underutilization of CRNAs despite the intent of executive orders to remove barriers. Several survey respondents indicated that despite the fact that their practice states were granted executive orders to practice at full SOP, institutional policies and restrictions played a greater role in continuing to limit CRNA expansion of practice. Reports suggest that even in states where governors removed requirements for physician supervision, some hospitals not only continued their physician supervision requirements but further hindered CRNAs by reassigning them to lower level roles instead of taking advantage of their comprehensive skill and expertise. This limitation of autonomy restricted CRNAs from caring for the critically ill patient population to their full SOP.

The results of this study support establishing an expanded SOP for CRNAs to better position the CRNA workforce to contribute at a high level during an emergency or crisis situation. In opt-out and rural areas, where CRNAs already exercise full SOP, they were more likely to be utilized outside the operating room, suggesting this may have allowed those hospitals a greater level of flexibility in managing the crisis. In states with supervision requirements, removal of this barrier resulted in greater changes in CRNA practice that potentially expanded

available staffing resources at hospitals stressed by high COVID-19 patient volume.

As the pandemic and the overall healthcare structure continue to push the system beyond its limitations, it may be prudent to further examine the impact of removal of barriers to practice. Indeed, in its 2016 deliberations, the National Academies' Committee for Assessing Progress on Implementing the Recommendations of the IOM Report *The Future of Nursing: Leading Change, Advancing Health* again concluded that healthcare reform aimed at removing practice barriers expands access to healthcare.¹⁶ Our findings support this recommendation, that removal of barriers provided access to care for critically ill patients by skilled CRNAs providing much-needed high-quality care.

• **Limitations.** A limitation to this study included the inability to fully assess the impact of hospital-level restrictions. The researchers surmised this impact by virtue of the participants' responses in open-ended responses. Another limitation of the study is the low response rate, which may be attributable to COVID-19 survey and communication fatigue. It is common for most practitioners to receive multiple communications from various sources, including employers, the state and federal entities, and their professional organization all in one day. The survey also closed in late August 2020 and does not reflect the Fall 2020 surge in cases, which may have further altered the landscape of the healthcare system and CRNA utilization.

• **Recommendations for Future Research.** Recommendations for future research include assessment of the long-term effects of the regulatory waivers and state executive orders on CRNA practice and the impact of hospital-specific restrictions on SOP. As of publication, it is not clear if or when many of the regulatory changes will revert back to the pre-COVID-19 state. It would also be of great interest to determine the level of engagement of CRNAs in assisting with COVID-19 vaccination programs as they become available, and the need for practitioners able, willing, and available to assist becomes more apparent.

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