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Variability in Anesthetic Care for Total Knee Arthroplasty: An Analysis from the Anesthesia Quality Institute

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Abstract

Background—Anesthetic practice utilization and related characteristics of total knee arthroplasties (TKA) are understudied. We sought to characterize anesthesia practice patterns by utilizing National Anesthesia Clinical Outcomes Registry (NACOR) data, operated by Anesthesia Quality Institute (AQI).

Methods—The proportions of primary TKAs performed between January 2010 and June 2013 using general anesthesia (GA), neuraxial (NA), regional (RA) were determined. Utilization of anesthesia types was analyzed using anesthesiologist and patient characteristics and facility type.

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Results—108,625 eligible TKAs were identified; 10.9%, 31.3%, 57.9 %, performed under GA, NA, RA, respectively. Patients receiving RA had higher median age and higher frequency of ASA score 3 compared to other anesthesia types under study. Relative to GA (45.0%), when NA or RA were utilized, the anesthesiologist was more frequently board certified (75.5%, 62.1% respectively, $p<0.0001$).

Conclusion—Anesthetic technique differences for TKAs exist with variability associated with patient and provider characteristics.

Introduction

Total knee arthroplasty (TKA) is highly effective in reducing pain and improving mobility in patients suffering from end-stage osteoarthritis.¹ The increase of TKAs in the United States (US) over the past 15 years has alarmed physicians, public health experts, and the general public.^{2,3} The number of annual TKAs doubled from 1999 to 2009 with over 700,000 TKAs performed in 2009.⁴ This surge has garnered attention towards developing criteria for surgical appropriateness,^{5,6} evaluating economic consequences,^{7–9} and looking for plausible causes for the increase.¹⁰ Researchers have examined implications of surgical decisions with perioperative outcomes.^{11,12}

Anesthesiologists play a critical role in TKA surgeries, with choice of anesthetic technique playing a significant role in favorable surgical outcomes.¹³ Recent literature has examined the relative benefit of regional (RA) or neuraxial (NA) anesthesia utilization in place of general anesthesia (GA) for TKAs.^{14,15} However, despite recent work, little is known about current anesthesia practice-related factors across the country. Variability of anesthesia practice patterns in the US may not necessarily be arbitrary.

Due to the lack of literature describing the differentiations of anesthetic technique and the root causes for this variability, the primary objective of this manuscript is to determine which patient, provider and facility demographics influenced anesthetic technique chosen. To achieve this goal, we used the Participant User File (PUF), a de-identified aggregation of all cases in the National Anesthesia Clinical Outcomes Registry (NACOR) of the Anesthesia Quality Institute (AQI). This is the largest national anesthesia database available. This study did not assess differences in outcomes based on anesthesia technique used, as this has been assessed previously.^{14,15} We hypothesized there is extensive variability in choice of anesthetic technique affected by various factors including patient age and health status, board certification status of the attending anesthesiologist, resident or certified registered nurse anesthetists (CRNAs) involvement, and facility type.

Materials and Methods

Data Source

Data were collected by AQI from January 2010 to June 2013 and consisted of 10,065,800 records amassed through the NACOR from over 100 heterogeneous sources.¹⁶ The data were accessed on June 24, 2013. NACOR is a voluntary data submission registry with the goal of facilitating the evaluation of quality in anesthesia care both locally and nationally.¹⁷ The registry is available to anesthesia providers in the US and represents an opportunity to

survey data from all provider types, from private practices to large-scale hospitals.¹⁸ The spectrum advantageously provides a glimpse into many sections of anesthetic care. The AQI database is de-identified and contains patient demographics, billing, procedural, diagnostic, and provider information. This project was approved by the Institutional Review Board (IRB) of Weill Cornell Medical College.

Study Sample

TKAs between the years of 2010 and 2013 were identified in this study by determining billing data containing either (1) a Clinical Classifications Software (CCS) label of “Arthroplasty Knee” or (2) a non-missing CCS label and a current procedural terminology (CPT) code of 27440, 27441, 27442, 27443, 27445, 27446, or 27447. Records excluded from this sample were those with knee revision CPT codes of either 27486 or 27487. The data were further restricted to exclude cases where primary anesthesia type was missing, included a technique other than GA, NA, or RA, or was coded as receiving multiple anesthesia types (due to small numbers [$n = 405$]). Additionally, cases where age, length of anesthesia procedure, facility type, or facility location was missing were excluded.

Demographic, Provider and Facility Variables

Patient, provider, and facility characteristics were compared by primary anesthesia type. As mentioned previously, the primary anesthesia types of interest included GA, NA, and RA. Although NA is a type of RA localized to the spinal column, the AQI database has the ability to make the distinction between NA and RA, therefore, these groups were analyzed separately. Patient demographics included age, sex and American Society of Anesthesiology (ASA) physical status. Information pertaining to the procedure itself is described in terms of the year and quarter in which the case occurred and length of time for the anesthesia procedure. Anesthesia provider information included whether residents or certified registered nurse anesthetists (CRNAs) were involved in the case and whether a board certified provider was present. Healthcare system-related characteristics included facility type (university hospital (UH), large community hospital (LCH) with over 500 beds, medium community hospital (MCH) with 100–500 beds, small community hospital (SCH) with under 100 beds, and other: specialty hospital, attached surgery center, freestanding surgery center, pain clinic, surgeon office, or not applicable) and geographic location (Northeast, Midwest, South, West).

Statistical Analysis

SAS version 9.3 (SAS Institute, Cary, NC) was used to perform all statistical analyses. P-values of <0.05 were considered indicative of significance between groups. For continuous variables with skewed distributions the median, interquartile range (Q1–Q3), and p-values were presented. Pearson’s chi-squared tests were used to compare categorical variables and one-way ANOVA tests were utilized to compare means for continuous variables when comparing the three anesthesia types.

Multinomial logistic regression was fitted to determine if patient, provider, and facility characteristics (patient age, patient sex, ASA score, year, length of anesthesia procedure, whether residents were present, whether CRNAs were present, board certification of

providers, facility type, and facility region) were associated with utilization of GA, NA, and RA. This model is a variant of the standard logistic regression and presents odds ratios for the relative odds of a predictor variable's association with each category (utilization of NA or RA) and the reference category (utilization of GA).

Sensitivity Analyses

In order to quantify the impact that excluding the previously mentioned records had on the modeling of association between relevant covariates and anesthesia technique, we conducted a sensitivity analysis. To do this, we compared the odds ratios for variables of interest by constructing three multinomial regression models with anesthesia type as the dependent variable: (1) excluding no records and coding missing anesthesia type or multiple anesthesia type as "MoMT," leading to a multinomial regression model with four dependent variables (RA, NA, GA, and MoMT); (2) excluding records where anesthesia type was missing or multiple types, but without excluding any records with absent data and recoding them as a string of "missing", and (3) the restricted model with all previously described where records were excluded based on the presence of missing values for independent variables, or the presence of missing or multiple types for anesthesia type.

Results

The complete AQI database query contained 10,065,800 records (Figure 1). We identified 144,922 records (1.4%) in which a primary TKA was performed. For 17.1% (n=24,711) of the records, anesthesia type was missing and these records were excluded from further analysis. For the remaining 120,211 cases, 57.1% (n = 68,679) were conducted under GA, 31.8% (n = 38,278) were conducted under NA, and 10.1% (n = 12,118) were conducted under RA. Additionally, 0.9% (n = 1,136) were coded to have received only monitored anesthesia care (MAC), sedation, local, or other. As it seems clinically improbable that a TKA was performed with just the latter types of anesthetic, these entries are likely representative of coding errors and were excluded. Furthermore, of the cases where primary anesthesia type was RA, NA, or GA (n = 119,075), those with missing values for patient age, case duration, facility type, or facility location were also excluded (n = 10,045). A total of 405 cases that received multiple anesthesia types were excluded due to small numbers. This resulted in a total study population of 108,625 records (GA: n = 62,865, NA: n = 33,964, and RA: n = 11,796).

Table 1 displays patient-related demographics. Patients who received GA were younger (median: 66 years, Q1: 58, Q3: 73) than those who received NA (median: 67 years, Q1: 60, Q3: 74) ($p < 0.0001$), or RA (median: 68 years, Q1: 61, Q3: 75). The proportion of patients receiving RA with an ASA classification greater than or equal to 3 was higher than patients receiving NA or GA (RA: 44.9%; NA: 37.7%; GA: 37.5%; $p < 0.0001$).

There was significant variation in intraoperative features between anesthesia types. Median length of anesthesia time was longest for patients receiving GA and shortest for RA (RA: 127 minutes (Q1: 103, Q3: 153); NA: 131 minutes (Q1: 115, Q3: 154); GA: 135 minutes (Q1: 113, Q3: 163); $p < 0.0001$), as noted in Table 2.

Provider statistics are also presented in Table 2. When NA or RA were utilized, most frequently it was by a board certified anesthesiologist (NA: 75.5%; RA: 62.1%; GA: 45.0%; $p<0.0001$). CRNA involvement was highest in situations where RA was used and lowest for NA (RA: 57.5%; NA: 37.8%; GA: 44.6%; $p<0.0001$). Resident involvement followed a different trend – involvement was highest when NA was administered and lowest with RA (RA: 0.7%; NA: 7.5%; GA: 4.3%; $p<0.0001$).

Descriptive statistics of the providers' hospitals are found in Table 3. The greatest number of overall procedures were performed in MCHs and LCHs with 62.8% ($n=68,254$) and 18.4% ($n=20,026$) of the total TKAs, respectively. Less frequently used facilities were SCHs and UHs, where 5.1% ($n=5,504$) and 1.4% ($n=1,481$) of the total procedures were performed, respectively. MCHs were the most common location for utilization of all anesthesia types, though GA (62.6%) and NA (70.0%) administered cases were more common than RA (43.4%) cases. For LCHs and SCHs, there was less utilization of GA (LCH: 15.6%; SCH: 4.3%) and NA (LCH: 19.3%; SCH: 3.7%) and more utilization of RA (LCH: 31.3%; SCH: 13.2%) ($p<0.0001$).

The number of TKAs performed was not distributed evenly across US regions. The South and Midwest performed 31.6% ($n=34,360$) and 33.4% ($n=36,300$) of all procedures, respectively, while the Northeast performed 18.7% ($n=20,310$) and the West performed 16.3% ($n=17,655$) ($p<0.0001$). Additionally, different regions tended to favor the utilization of different anesthesia techniques. In the South, a higher proportion of cases were performed with GA and RA than cases with NA (RA: 32.9%; NA: 27.1%; GA: 33.8%).

In the Midwest there was an opposite trend, with a higher proportion of cases performed with NA, but the minority of cases with RA (RA: 15.3%; NA: 45.6%; GA: 30.2%). In the Northeast a higher proportion of cases were performed with RA (34.5%) than NA or GA (11.0% and 19.9%). The West had a relatively equal proportion of cases performed between anesthesia types (RA: 17.4%; NA: 16.3%; GA: 16.0%).

Multinomial Logistic Regression

In order to identify whether certain variables of interest, such as age, ASA classification and board certification status were associated with a specific type of anesthesia, we constructed a multinomial logistic regression model to compare anesthesia technique used, controlling for confounding factors.

An association was identified between age and type of anesthesia used. When comparing age group 65 – 74 to 55 – 64, the odds for using NA relative to GA were elevated (NA: 1.14 (1.10, 1.18), $p<0.0001$) as were the odds of using RA relative to GA were elevated (RA: 1.15 (1.09, 1.21), $p<0.0001$) [Table 4]. Using the same referent group, patients aged 75 had increased odds for using NA relative to GA, or RA relative to GA (NA: 1.15 (1.10, 1.20), $p<0.0001$; RA: 1.23 (1.16, 1.30), $p<0.0001$) [Table 4]. For younger patients (45–54 years and those 44 years), there was an increase in odds of GA being used relative to NA or RA [Table 4].

An association was noted between ASA classification and choice of anesthetic type. The relative odds of having an ASA classification of 2 and higher compared to ASA of 1 was significantly higher for RA relative to GA (2: 6.50 (5.86, 7.20), $p<0.0001$; 3+: 5.27 (4.77, 5.83), $p<0.0001$). Patients with higher ASA classifications were also more likely to receive NA than GA, although the relative odds were lower than in the comparison between RA and GA [Table 4].

When comparing board certification status by anesthetic technique, board certified physicians were found to have an increased odds of utilizing NA (3.44 (3.30, 3.59); $p<0.0001$) or RA (2.43 (2.29, 2.58); $p<0.0001$) relative to GA.

It is also noteworthy that the odds associated with use of RA relative to GA increased annually (2011: 0.96 (0.90, 1.02) $p=0.15$; 2012: 1.30 (1.23, 1.38) $p<0.0001$; 2013: 1.65 (1.53, 1.78) $p<0.0001$).

Sensitivity Analysis

A sensitivity analysis was performed to validate that the exclusion of records missing key data did not modify or reverse outcomes and conclusions. We found that a separate multinomial regression model where no records were excluded from the TKA cohort produced similar results and identical conclusions. [results not shown]

Discussion

In this study we found that TKAs were disproportionately performed under GA (with the highest proportion of cases performed in MCH) followed by NA, and RA. We found that GAs utilization has decreased annually since 2010, while utilization of NA and RA has steadily increased. This finding is highly relevant in the context of the ongoing discussion regarding how perioperative outcomes from TKAs may be influenced by anesthesia technique. While some recent publications have suggested that the outcomes of cases using GA are improved or equivalent to those using NA and RA,¹⁹ a number of papers^{14,20,21} demonstrated that TKAs performed under GA tend to have higher rates of complications than those under NA and RA. A missing link in the lengthy discussions of anesthesia technique is the prevalence of the practice patterns under investigation; our study attempts to provide this information. As more literature accumulates favoring RA and NA over GA for TKAs, it is remarkable that RA is utilized in such a small proportion of TKA cases. Furthermore, few of the studies supporting or discouraging GA for TKAs control for patient-related variables, such as age, ASA physical status, or physician-related characteristics, such as board certification status, which may contribute to the relative benefits of an anesthesia technique. Our study utilized these patient, provider, and facility-related variables and provides an essential foundation for future investigations of perioperative outcomes based on choice of anesthesia technique.

As a result of using a large, nationally-representative database, we were able to identify several features that tend to characterize cases where NA or RA are more likely to be utilized instead of GA. After using multinomial logistic regression to control for contributing variables, such as gender, year, length of anesthesia, resident or CRNA

involvement, facility type and region, we found that TKA cases utilizing RA or NA was associated with a patient population that is older and classified with higher ASA scores than those receiving GA. Secondly, NA and RA were more likely to have a board certified provider present.

Past studies have evaluated differences in practice patterns between board certified and non-board certified providers²² and considered specialized anesthetic care of the elderly,²³ but no study has applied these questions to the growing number of TKA procedures. We have demonstrated that vast differences exist in anesthesia utilization both with regard to the providers involved and the patients being treated. However, additional analyses are needed to assess provider related differences.

Additionally, this study demonstrated the utility of the AQI database in providing patient demographics and provider practice patterns. With several large databases of clinical information currently available, the possibilities associated with large observational cohort studies have never been more promising. Still, each database has its own advantages and limitations.²⁴ Commercial databases such as Premier and the National Inpatient Sample (NIS) represent valuable resources for large amounts of patient data for a number of relevant variables. Information stored in these databases is uniform, but these databases are expensive to acquire, and tend to contain little information pertaining to provider characteristics and practice patterns of anesthesia providers.

The AQI database consists of information surveyed from participating anesthesia practices across the US and has limited inclusion criteria with a strong focus on clinical care. They practice medicine in facilities that range from large and small hospitals to private practices, from facilities that store medical records electronically to those that do not. Thus, the massive cross-sectional perspective provided by the AQI database gives researchers national data of current anesthesia practices.

Limitations

The first principal limitation of this study arises from the nature of the AQI database. Although AQI provides a valuable data resource, it also has several drawbacks. Data are collected from numerous facility types and different facilities tend to enter data into the registry in different formats, different levels of detail, and with different numbers of entries. The lack of uniformity in the data leads to an increased number of missing data. In this study the issue of missing data was addressed by conducting a sensitivity analysis, which revealed similar results with an identical conclusion. However, the unfortunate heterogeneity in procedures for data entry is particularly relevant for outcomes variables. While NACOR currently accepts entry of outcomes variables, due to the different entry patterns of facilities, robust analysis of intraoperative or postoperative outcomes is not yet possible.

Second, this study has certain limitations inherent to any retrospective, observational study. The data utilized for this study may have data entry errors or miscoding, potentially leading to the misclassification of some records. However, this classification is most likely non-differential and would lead to a dilution of the effects noted. Furthermore, this study does not address the outcomes of the cases under investigation. Finally, no causal relationships

can be established from our data. Therefore, we cannot ascertain why a specific anesthetic was chosen and by whom.

Lack of outcomes-based analysis effectively dictates that the descriptive statistics of this study are a ceiling for the inferences that the AQI database permits; descriptive studies encourage hypotheses for evidence-based medicine, but do not produce hypotheses independently.

Conclusion

In conclusion, our study is among the first to systematically analyze the patient and provider demographic variables associated with different anesthesia techniques in TKA. We were able to identify several significant factors that are associated with the utilization of GA, NA, or RA, including the increased trend in the use of RA since 2010, and the increased odds of RA and NA among older patients and among patients with higher ASA scores compared to GA. Furthermore, NA and RA had increased odds of the presence of a board certified physician relative to GA. Accompanied with the results of recent perioperative outcomes research on TKA anesthesia choice, the need for additional investigation in this area seems clear. Our data should provide a strong foundation for research in clinically relevant, evidence-based medicine and should spark attempts to expand and improve anesthesia-specific data collection constructs, such as the AQI, to allow for more detailed analyses.

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Figure 1.
Total knee arthroplasty (TKA) study population from the Anesthesia Quality Institute (AQI): January 2010 to June 2013

Table 1

General Demographics Statistics for Knee Arthroplasty by Anesthesia Type

Category	General		Neuraxial		Regional		Total		P-Value
	n	%	n	%	n	%	n	%	
N	62,865	57.9	33,964	31.3	11,796	10.9	108,625		
Average Age (Years)									
Median (Q1, Q3)	66 (58, 73)		67 (60, 74)		68 (61, 75)		67 (59, 74)		<.0001
Age Group (%)									
0-44	3,635	5.8	378	1.1	174	1.5	4,187	3.9	<.0001
45-54	6,724	10.7	3,206	9.4	1,062	9.0	10,992	10.1	
55-64	17,464	27.8	9,911	29.2	3,112	26.4	30,487	28.1	
65-74	21,265	33.8	12,475	36.7	4,320	36.6	38,060	35.0	
75+	13,777	21.9	7,994	23.5	3,128	26.5	24,899	22.9	
Gender									
Male	23,621	37.6	12,490	36.8	4,543	38.5	40,654	37.4	<.0001
Female	37,448	59.6	21,308	62.7	7,253	61.5	66,009	60.8	
Missing	1,796	2.9	166	0.5	0	0.0	1,962	1.8	
ASA Class									
1	12,243	19.5	5,048	14.9	474	4.0	17,765	16.4	<.0001
2	22,829	36.3	15,923	46.9	5,388	45.7	44,140	40.6	
3 or higher	23,569	37.5	12,816	37.7	5,294	44.9	41,679	38.4	
Missing	4,224	6.7	177	0.5	640	5.4	5,041	4.6	

* N % unless otherwise specified.

Percents may not total to 100 due to rounding.

Table 2
Intraoperative and Provider Statistics for Knee Arthroplasty by Anesthesia Type

Category	General		Neuraxial		Regional		Total		P-Value
	n	%*	n	%	n	%	n	%	
N	62,865	57.9	33,964	31.3	11,796	10.9	108,625		
Year									
2010	15,917	25.3	8,988	26.5	2,668	22.6	27,573	25.4	<.0001
2011	18,545	29.5	10,044	29.6	2,853	24.2	31,442	28.9	
2012	22,299	35.5	12,267	36.1	4,593	38.9	39,159	36.0	
2013	6,104	9.7	2,665	7.8	1,682	14.3	10,451	9.6	
Quarter									
1	19,194	30.5	10,310	30.4	4,039	34.2	33,543	30.9	<.0001
2	15,326	24.4	8,545	25.2	2,594	22	26,465	24.4	
3	13,531	21.5	7,397	21.8	2,522	21.4	23,450	21.6	
4	14,814	23.6	7,712	22.7	2,641	22.4	25,167	23.2	
Anesthesia Time in Minutes									
Median (Q1, Q3)	135 (113, 163)		131 (115, 154)		127 (103, 153)		133 (113, 159)		<.0001
Anesthesia Time (Hours)									
0 to <1.5 hr	5,599	8.9	1,105	3.3	1,579	13.4	8,283	7.6	<.0001
1.5 hr to <2 hr	14,247	22.7	9,692	28.5	3,325	28.2	27,264	25.1	
2 hr to <2.5 hr	20,865	33.2	13,326	39.2	3,611	30.6	37,802	34.8	
2.5 hr or more	22,154	35.2	9,841	29.0	3,281	27.8	35,276	32.5	
Anesthesia Providers									
Resident Involvement	2,686	4.3	2,535	7.5	86	0.7	5,307	4.9	<.0001
CRNA Involvement	28,024	44.6	12,838	37.8	6,778	57.5	47,640	43.9	<.0001
Board Certification Present									
Yes	28,315	45.0	25,634	75.5	7,324	62.1	61,273	56.4	<.0001
No	20,409	32.5	4,023	11.8	2,529	21.4	26,961	24.8	
Missing	14,141	22.5	4,307	12.7	1,943	16.5	20,391	18.8	

* N % unless otherwise specified.

Percents may not total to 100 due to rounding.

Table 3**Hospital Statistics for Knee Arthroplasty by Anesthesia Type**

Category	General		Neuraxial		Regional		Total		P-Value
	n	%	n	%	n	%	n	%	
N	62,865	57.9	33,964	31.3	11,796	10.9	108,625		
Facility Type									
University Hospital	741	1.2	684	2	56	0.5	1,481	1.4	<.0001
Large Community Hospital (over 500 beds)	9,790	15.6	6,542	19.3	3,694	31.3	20,026	18.4	
Medium Community Hospital (100–500 beds)	39,353	62.6	23,779	70.0	5,122	43.4	68,254	62.8	
Small Community Hospital (less than 100 beds)	2,703	4.3	1,240	3.7	1,561	13.2	5,504	5.1	
NA	6,348	10.1	643	1.9	1,071	9.1	8,062	7.4	
Other	3,930	6.3	1,076	3.2	292	2.5	5,298	4.9	
Region									
Northeast	12,512	19.9	3,730	11	4,068	34.5	20,310	18.7	<.0001
Midwest	19,005	30.2	15,494	45.6	1,801	15.3	36,300	33.4	
South	21,273	33.8	9,207	27.1	3,880	32.9	34,360	31.6	
West	10,075	16.0	5,533	16.3	2,047	17.4	17,655	16.3	

* N % unless otherwise specified.

Percents may not total to 100 due to rounding.

Table 4

Results from Multinomial Logistic Regression Model for the Outcome of Anesthesia Type Displayed are odds ratio (95% confidence intervals)

Category	Reference	Neuraxial vs. General	Regional vs. General
Age Group	55–64		
<=44		0.21** (0.18, 0.23)	0.36** (0.30, 0.42)
45–54		0.84** (0.80, 0.89)	0.89** (0.82, 0.96)
65–74		1.14** (1.10, 1.18)	1.15** (1.09, 1.21)
>=75		1.15** (1.10, 1.20)	1.23** (1.16, 1.30)
Gender	Male		
Female		1.03 (1.00, 1.06)	0.96 (0.92, 1.00)
ASA Class	1		
2		1.64** (1.57, 1.71)	6.50** (5.86, 7.20)
3 or higher		1.22** (1.17, 1.28)	5.27** (4.77, 5.83)
Year	2010		
2011		1.08** (1.04, 1.13)	0.96 (0.90, 1.02)
2012		1.27** (1.22, 1.32)	1.30** (1.23, 1.38)
2013		1.14** (1.08, 1.21)	1.65** (1.53, 1.78)
Anesthesia Time	2 hr to less than 2.5 hr		
Less than 1.5 hr		0.34** (0.31, 0.36)	1.58** (1.46, 1.70)
1.5 to <2 hr		1.04** (1.01, 1.08)	1.39** (1.32, 1.47)
2.5 hr or greater		0.66** (0.63, 0.68)	0.83** (0.78, 0.87)
Resident Present	No		
Yes		1.29** (1.20, 1.40)	0.11** (0.08, 0.13)
CRNA Present	No		
Yes		0.82** (0.79, 0.85)	1.46** (1.39, 1.53)
Board Certification	No		
Yes		3.44** (3.30, 3.59)	2.43** (2.29, 2.58)
Facility Type	MCH		
UH		2.07** (1.82, 2.35)	1.34** (1.00, 1.80)
LCH		1.04 (1.00, 1.09)	2.11** (2.00, 2.22)
SCH		0.69** (0.64, 0.74)	3.21** (2.99, 3.45)
NA		0.25** (0.23, 0.27)	1.03 (0.94, 1.12)
Other		0.47** (0.44, 0.51)	0.81** (0.71, 0.91)
Region	Northeast		
Midwest		2.41** (2.30, 2.53)	0.27** (0.25, 0.29)
South		1.26** (1.20, 1.33)	0.40** (0.38, 0.42)
West		1.79** (1.69, 1.89)	0.65** (0.61, 0.70)

*
 $p < 0.05$

**
 $p < 0.001$

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