

Commercial and Medicare Advantage Payment for Anesthesiology Services

Erin L. Duffy, PhD, MPH; Bich Ly, BA; Loren Adler, MS; and Erin Trish, PhD

Anesthesiology service providers are a common source of surprise out-of-network bills.¹⁻⁴ Although there is widespread agreement that these surprise bills are unfair to patients, consensus around what is a reasonable payment standard for out-of-network services is lacking. The new federal surprise billing law, the No Surprises Act, addresses this question by creating an arbitration process to adjudicate disputes over out-of-network payment, with guidance to consider an issuer's median in-network allowed amount among other (less concrete) factors.⁵ Therefore, current in-network allowed amounts are important for regulators, stakeholders, and researchers to understand. However, systematic data on the magnitude of commercial payments for anesthesia are limited due to the unique and complex attributes of payment and service provision in this specialty. Using a multipayer claims database, we find that mean in-network commercial allowed amount conversion factors (CFs) for anesthesiology services (\$70) are 314% of the traditional Medicare rate, and mean charge CFs among commercial claims (\$148) are 659% of the traditional Medicare rate (Figure 1). Unlike traditional Medicare—which uses the same CF regardless of whether the service is provided by an anesthesiologist or a certified registered nurse anesthetist (CRNA)—we find that private insurer payments tend to vary across provider delivery structures for commercial but not Medicare Advantage (MA) enrollees (Figure 2).

STUDY DATA AND METHODS

We analyzed 2016 and 2017 commercial and MA claims data from the Health Care Cost Institute (HCCI), comprising claims from 61 million commercial and 8.9 million MA covered lives in 3 of the 5 largest US insurers: UnitedHealthcare, Aetna, and Humana.⁶ Our analytic sample includes claims for the 10 most common professional anesthesiology services among commercial payers in outpatient hospital and ambulatory surgery center (ASC) settings. We excluded claims with anomalies that affect payment rates in ways that we could not reasonably address (detailed exclusion criteria in eAppendix 1 [eAppendices available at ajmc.com]).

ABSTRACT

OBJECTIVES: Anesthesiology services are a focal point of policy making to address surprise medical billing. However, allowed amounts and charges for anesthesiology services have been understudied due to the specialty's unique conversion factor (CF) unit of payment and complex provider structures involving anesthesiologists and certified registered nurse anesthetists (CRNAs). This study compares payments for common outpatient anesthesiology services by commercial health plans, Medicare Advantage (MA), and traditional Medicare.

STUDY DESIGN: Analysis of 2016-2017 claims from Health Care Cost Institute.

METHODS: We derived allowed amount and charge CFs for commercial and MA claims using the base units assigned to each procedure code, time units, and modifiers. We computed the ratio of the allowed amount and charge CFs relative to the traditional Medicare CF. We described these payment measures by provider structure and network status.

RESULTS: Mean in-network commercial allowed amount CFs for anesthesiology services (\$70) are 314% of the traditional Medicare rate (\$22), whereas mean commercial charge CFs (\$148) are 659% of the Medicare rate. Commercial payments vary widely and are higher to anesthesiologists than to CRNAs and higher out of network than in network. MA plan payments align with traditional Medicare with payment parity between anesthesiologists and CRNAs, both in network and out of network.

CONCLUSIONS: Common payment measures for anesthesia services—commercial allowed amounts, charges, or traditional Medicare—are highly divergent. MA plans' relatively low payments likely reflect the cost-containing influence of competition with traditional Medicare and MA's prohibition on balance billing. Out-of-network benchmarks for anesthesia services, such as the "qualifying payment amount" used in the No Surprises Act as a guidepost for arbitrators, may benefit from considering commercial payment differences across independent anesthesiologist, independent CRNA, or anesthesiologist-CRNA dyad provider structures.

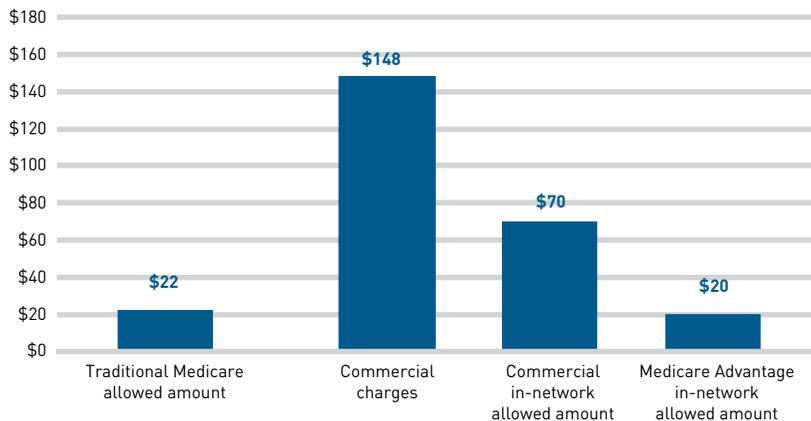
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TAKEAWAY POINTS

This study of 2016-2017 administrative claims compares payments for common outpatient anesthesiology services by commercial health plans, Medicare Advantage (MA), and traditional Medicare.

- ▶ Mean in-network commercial allowed amounts (\$70) and charges (\$148) per anesthesia conversion factor are 314% and 659% of the traditional Medicare rate (\$22).
- ▶ Commercial allowed amounts are higher for anesthesiologists than for certified registered nurse anesthetists (CRNAs) and higher out of network than in network.
- ▶ MA plans pay on par with traditional Medicare for anesthesiologists and CRNAs, both in network and out of network, likely reflecting the cost-containing influence of competition with traditional Medicare and MA's prohibition on balance billing.

FIGURE 1. Mean Charge and In-Network Allowed Amount Anesthesia Conversion Factors Relative to Traditional Medicare for Anesthesiologists and CRNAs*



CRNA, certified registered nurse anesthetist.

*Mean charges include in-network, out-of-network, and unknown network commercial claims for independent anesthesiologist and CRNA services. Mean in-network allowed amounts for commercial and Medicare Advantage claims include independent anesthesiologist and CRNA services and anesthesiologist-CRNA dyads. The charge and allowed amount conversion factors are in nominal dollars. Source: Authors' analysis of 2016-2017 Health Care Cost Institute commercial and Medicare Advantage claims data.

Traditional Medicare reimbursement for anesthesia is not determined by the typical physician fee schedule based on relative value units. Rather, payments for anesthesia are calculated using base (start-up) units that are assigned according to the complexity of different procedures and time units accounting for procedure length.^{7,8} Traditional Medicare converts these units to an allowed amount based on a CF that is set annually. For example, anesthesia for an eye lens surgery (procedure code 00142) is assigned 4 base units. If an anesthesia provider spends 30 minutes performing this service on a Medicare beneficiary, then that provider would be reimbursed for the 4 base units plus the two 15-minute time units. These 6 units would be multiplied by the traditional Medicare allowed amount CF, which was approximately \$22 in the years 2016 and 2017, with modest variation between years and across geographic areas. The total allowed amount reimbursed to the

provider would, therefore, be approximately \$132. Commercial payers also tend to negotiate anesthesia reimbursement at the CF level, and this unique billing structure adds complexity to claims-based analyses comparing commercial reimbursement for anesthesia with traditional Medicare rates.

Some anesthesiology services are provided by physicians, whereas others are provided by CRNAs, either with or without medical direction by a physician. When a physician supervises the CRNA (ie, a supervisory dyad), the anesthesiologist supervisor and CRNA supervisee each receive half of what they would be paid if they independently provided the service, and anesthesiologists can medically direct several services simultaneously.⁷ Additional units are also added to base and time units if a patient is less healthy.⁷ Therefore, a simple comparison of total allowed amounts across commercial and MA plans would not be an accurate measure of differences in negotiated rates due to confounding differences in provider structures, procedure times, and patients' underlying health status.

To address this complexity, we derived allowed amount CFs and billed charge CFs for commercial and MA claims using the base units assigned to each procedure code, time units, and modifiers indicating provider type (detailed methods in [eAppendix 2](#)).⁷ For each claim, we also computed the ratio of the allowed amount CF and charge CF relative to the traditional Medicare allowed amount CF, which averaged \$22.31, accounting for year and geographic variation. We also calculated the 20th percentile, median, and 80th percentile

of the distribution of allowed amount CFs and charge CFs among commercial and MA plans in dollars and as ratios to traditional Medicare CFs.

We stratified our analyses by provider type because, whereas traditional Medicare uses the same CF regardless of provider type, that is not necessarily the case among commercial and MA payers (detailed methods in [eAppendix 3](#)). To facilitate comparison, for anesthesiologist-CRNA supervisory dyads we report full allowed amount CFs separately for the supervising anesthesiologist and CRNA supervisee, although we note that in practice these amounts are generally halved by commercial and MA plans as well. We could not derive the charge CF for these dyads because of inconsistency in whether the magnitudes of reported charges are halved. We also categorized services by provider network status according to claim-level indicators in the HCCI data.

We excluded inpatient anesthesia services because unreliable or inconsistent reporting of time units on the majority of inpatient claims in our data set prohibited us from accurately deriving allowed amount CFs and charge CFs. We also excluded claims with modifiers for unhealthy patients due to potential inconsistency in whether additional units for a patient's health were incorporated into the reported units on the claims. All dollar values presented reflect nominal 2016 and 2017 US\$.

RESULTS

Our analytic sample included 3.59 million commercial claims and 1.87 million MA claims for the 10 most common professional anesthesiology services in outpatient hospital and ASC settings in 2016-2017 HCCI data. These 10 services represent 62% of anesthesiology services in these settings.

Provider Structure and Network Status

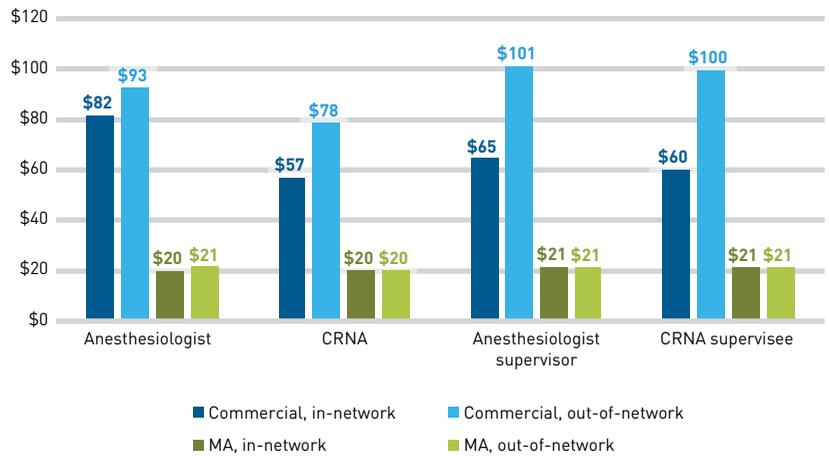
Among commercial claims, independent anesthesiologists provided the highest volume of procedures (43.5% of procedures), followed by independent CRNAs (38.2%) and anesthesiologist-CRNA supervisory dyads (18.2%). Among MA claims, independent CRNAs were the most common (48.2%), followed by independent anesthesiologists (27.5%) and anesthesiologist-CRNA supervisory dyads (24.3%) (Figure 3).

Out-of-network anesthesiology services were much more common among MA (41.2%) than commercial (8.3%) patients, but similar across provider structures within plan type (Appendix Exhibit 4.1).

Mean Commercial and MA Allowed Amounts

Although the overall mean commercial in-network allowed amount CF for anesthesia services in our sample for all provider types was \$70 (314% of traditional Medicare), we found that the commercial in-network allowed amount CF varied across provider structures, averaging \$82 for independent anesthesiologists and \$57 for independent CRNAs (Figure 2). Commercial allowed amount CFs for supervisory dyads averaged \$65 and \$60 for supervising anesthesiologists and CRNA supervisees, respectively (Figure 2). Because the traditional Medicare rate is flat across these different provider structures, these mean commercial allowed amount CFs ranged from 259% to 360% of

FIGURE 2. Mean Allowed Amount Conversion Factors Among Commercial and MA Claims by Network Status and Provider Structure*

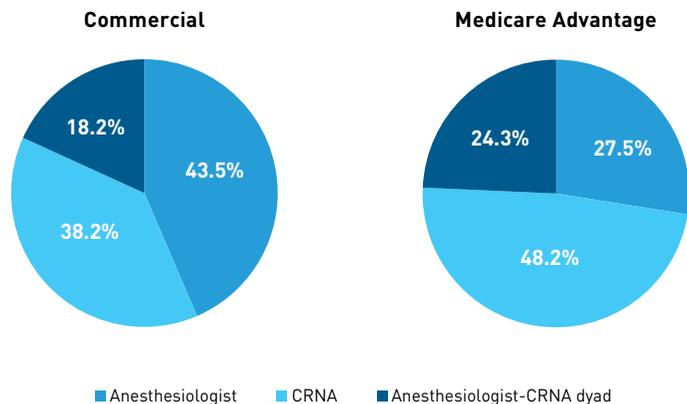


CRNA, certified registered nurse anesthetist; MA, Medicare Advantage.

*Unknown network status commercial claims are excluded.

Source: Authors' analysis of 2016-2017 Health Care Cost Institute commercial and MA claims data.

FIGURE 3. Provider Structure Composition for Anesthesia Services Among Commercial and Medicare Advantage Claims*



CRNA, certified registered nurse anesthetist.

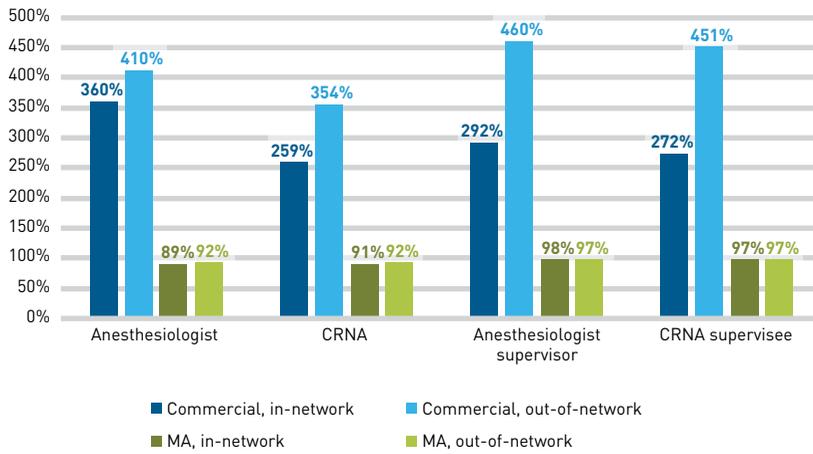
*Percentages may not sum to 100% due to rounding.

Source: Authors' analysis of 2016-2017 Health Care Cost Institute commercial and Medicare Advantage claims data.

traditional Medicare rates for independent CRNAs and independent anesthesiologists, respectively (Figure 4). In contrast, for MA patients, mean in-network allowed amount CFs were relatively consistent across all provider structures (\$20-\$21) (Figure 2).

Within each provider structure, commercial out-of-network allowed amount CFs were higher than in-network allowed amount CFs (Figure 2). Commercial allowed amount CFs paid to out-of-network providers were highest to anesthesiologist-CRNA supervisory dyads

FIGURE 4. Mean Percentage of Allowed Amount Anesthesia Conversion Factors Relative to Traditional Medicare^a

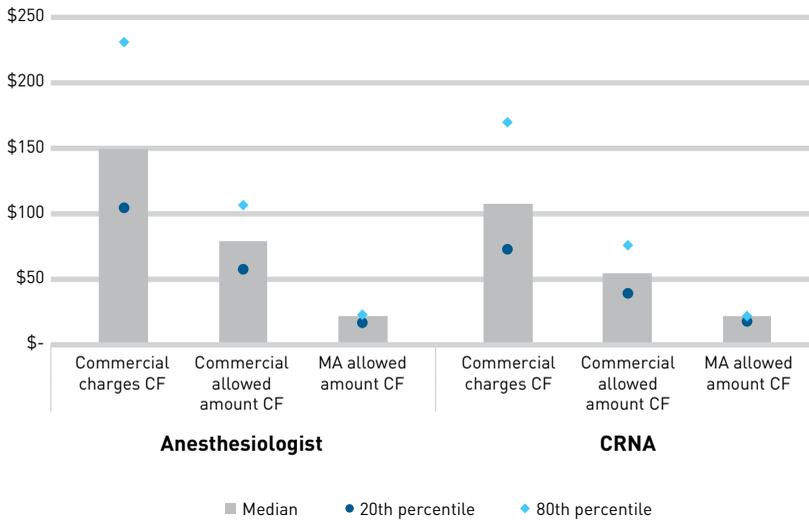


CRNA, certified registered nurse anesthetist; MA, Medicare Advantage.

^aUnknown network status commercial claims are excluded.

Source: Authors' analysis of 2016-2017 Health Care Cost Institute commercial and MA claims data.

FIGURE 5. Distribution of Charge and Allowed Amount Anesthesia CFs Among Commercial and MA Claims^a



CF, conversion factor; CRNA, certified registered nurse anesthetist; MA, Medicare Advantage.

^aThe charge and allowed amount CFs include in-network, out-of-network, and unknown network status claims and exclude claims for anesthesiologist-CRNA supervisory dyads. **eAppendix 5** presents 20th percentile, median, and 80th percentile nominal dollar values and percentages relative to traditional Medicare.

Source: Authors' analysis of 2016-2017 Health Care Cost Institute commercial and Medicare Advantage claims data.

(\$101 and \$100 for supervising anesthesiologists and CRNA supervisees, respectively, compared with \$93 and \$78 for independent anesthesiologists and CRNAs, respectively). In contrast, mean MA allowed amount CFs were relatively consistent across in- and out-of-network providers for all provider structures.

Distributions of Allowed Amounts and Charges

There is much greater variation in the allowed amount CF paid by commercial plans than MA plans (**Figure 5**). The 20th to 80th percentile range for commercial payments is \$57 to \$106 (255%-469% of traditional Medicare) for anesthesiologists and \$39 to \$76 (178%-349% of traditional Medicare) for CRNAs (data shown in **eAppendix 5**). However, the 20th to 80th percentile range of MA allowed amount CF is \$16 to \$23 (72%-100% of traditional Medicare) for anesthesiologists and \$17 to \$22 (80%-100% of traditional Medicare) for CRNAs. Notably, the allowed amount CF distributions are nearly equivalent between anesthesiologists and CRNAs for MA plan payments.

Median commercial charge CFs are much higher than allowed amount CFs at \$149 and \$108 for anesthesiologists and CRNAs, respectively. The 20th to 80th percentile range of commercial charge CFs is skewed higher for independently performed anesthesiologist services (\$104-\$231; 466%-1009% of traditional Medicare) than CRNA services (\$73-\$169; 330%-772% of traditional Medicare).

DISCUSSION

Anesthesiology's unique CF payment methodology and provider delivery structure make it difficult to reliably compare claim-level charges and allowed amounts across payers and populations. This complicates regulatory efforts to benchmark service prices or set out-of-network payment limits for anesthesiology services when addressing surprise billing (whether through a simple benchmark or arbitration). Whereas prior studies of administrative claims analyzed total allowed amounts³ and charges⁹ for anesthesia services, ours is the first (to our knowledge) to derive and compare anesthesia payments per CF to inform policies addressing surprise billing for anesthesiology services

and the arbitrators adjudicating out of network payment disputes under the new No Surprises Act. We found that commercial plans pay a mean allowed amount CF of \$70 for anesthesia services across all provider types and structures combined, which is 314% of the traditional Medicare rate. Our observed commercial markups over Medicare for anesthesia services are on par with the markups estimated by prior studies of payment to anesthesiologists³ and other hospital-based physician specialties that commonly surprise bill, such as radiology, pathology, and emergency medicine.¹⁰⁻¹² For example, in an analysis of 2016 commercial claims from multiple insurers, Song observed average in-network commercial payments for procedures commonly performed by radiologists (chest x-ray Current Procedural Terminology [CPT] 71020), pathologists (examination CPT 88305), and emergency medicine physicians (visit CPT 99285) to be 260%, 360%, and 250% of Medicare, respectively.¹⁰ These markups are much higher than those of other specialties, as an analysis of 2017 HCCI commercial claims estimated that professional allowed amounts averaged 122% of Medicare allowed amounts across all specialties nationally.¹¹

Additionally, we found that anesthesia providers' mean charge CFs (\$148) are more than double the mean commercial in-network allowed amount CF and 659% of the traditional Medicare allowed amount CF. A prior study of the ratio of charges to Medicare allowed amounts across specialties estimated that mean charges among specialties that do not typically surprise bill patients are 260% of Medicare allowed amounts, whereas charges relative to Medicare rates are much higher among diagnostic radiology (400%), pathology (350%), emergency medicine (540%), and anesthesiology (670%).¹³ This finding suggests that the ratio of charges relative to Medicare rates is much higher for anesthesia services than for other specialties, even in comparison with the other specialties that are often associated with surprise billing.

We observed that out-of-network allowed amounts are higher than in-network allowed amounts for commercial plans, suggesting one reason why providers might not be strongly incentivized to come in-network. This trend is not unique to anesthesia, as a prior study showed commercial payments to be higher out of network than in network for professional services across several specialties, including orthopedics, cardiology, gastroenterology, radiology, and pathology.¹⁴ Many specialties performing elective services rely on network participation for higher patient volume and are therefore willing to accept lower in-network payments from health plans in exchange for a higher volume of the health plan's enrollees. However, ancillary specialists such as anesthesiologists are less dependent on network status for patient volume because they are not typically preselected by patients. Therefore, anesthesiologists may be less inclined to move in network when they would face lower allowed amounts upon contracting with health plans. This may be a driving factor of the trend reported in prior studies that anesthesiologists are more commonly out of network than other specialties.^{4,12}

Due to wide variation in payment measures, policy makers addressing surprise billing should choose out-of-network payment

benchmarks prudently. For example, based on our analyses, an out-of-network payment benchmark for anesthesiologists practicing independently set at the median (\$79) or mean (\$82) commercial allowed amount per CF would be approximately 350% or 360%, respectively, of the traditional Medicare rate (\$22) (Figures 2 and 4 and eAppendix 5). Benchmarks of the median (\$149) and 80th percentile (\$231) of anesthesiologists' commercial charges CF would be approximately 652% and 1009% of the traditional Medicare rate, respectively (Figure 5 and eAppendix 5). Thus, both the source—commercial allowed amounts, charges, or traditional Medicare—and the distributional point employed in out-of-network payment benchmarking will substantially influence the magnitude of payments to anesthesiology providers. Further, our findings suggest that out-of-network benchmarks for anesthesia services, such as the “qualifying payment amount” (in general, an issuer's median in-network rate locally) used in the No Surprises Act as a guidepost for arbitrators, may benefit from taking into account commercial payment differences across independent anesthesiologist, independent CRNA, or anesthesiologist-CRNA dyad provider structures.

We also found that MA plans track CMS' payment level per CF for anesthesia services, consistent with prior studies of hospitals and other professional specialties that found MA provider payment levels often follow traditional Medicare rates.¹⁴⁻¹⁶ This payment parity exists for in-network and out-of-network services despite the high prevalence of out-of-network anesthesia services in MA (41.2%) (eAppendix Exhibit 4.1). This suggests that the threat of remaining out of network has little effect on in-network prices paid to anesthesia providers by MA plans, in contrast to what evidence suggests to be the case in the commercial market.³ This is likely driven by a combination of 2 factors. First, providers participating in Medicare are prohibited from collecting more than the traditional Medicare allowed amount for out-of-network services provided to MA enrollees, and most professionals participate in Medicare.^{8,17} Nonparticipating providers are also prohibited from collecting more than 109.25% of the traditional Medicare allowed amount for out-of-network services provided to MA enrollees.⁸ This strictly limits total out-of-network reimbursement to providers and patients' liability for balance bills in MA plans. Second, MA plans compete with traditional Medicare for enrollees and therefore need to keep costs sufficiently low to maintain affordable premiums and be actuarially viable.¹⁶ This cap on total reimbursement regardless of network status and the limited liability for patients receiving out-of-network services reduces the incentive to contract on the part of both providers and health plans.

Inclusion of advanced practice nursing specialists (eg, nurse practitioners) has been shown to reduce costs in some settings by increasing labor supply and competition, and more directly by augmenting or substituting for physician services at a lower cost.^{18,19} Such savings are realized in the commercial market for anesthesia services, where we observed that plans paid lower allowed amounts CF to CRNAs than to anesthesiologists. However, traditional Medicare

does not vary pricing per CF across anesthesiologists, CRNAs, and supervisory dyad provider structures, and we found that MA plans share this payment parity across provider types. More work is needed on the benefits of CRNAs practicing independently and under the supervision of anesthesiologists, but our study suggests that expanding the inclusion of CRNAs in anesthesia services may yield direct cost savings for commercial plans. There may also be indirect effects of CRNA practice on reducing costs not captured in our analysis, such as increased labor supply and competition.

Limitations

Limiting our analysis to a subset of procedures in the outpatient and ASC settings and applying other exclusions strengthened the accuracy of CF estimates within our sample but may reduce generalizability. Findings may not be generalizable to health plans beyond our sample.

CONCLUSIONS

Anesthesia CF commercial allowed amounts, traditional Medicare rates, and charges differ substantially in magnitude. MA plans' relatively low payments likely reflect the cost-containing influence of competition with traditional Medicare and MA's prohibition on balance billing. Policy makers addressing surprise billing for commercial enrollees should choose out-of-network payment benchmarks prudently to avoid inflationary out-of-network benchmarks. Additionally, out-of-network benchmarks for anesthesia services, such as the "qualifying payment amount" used in the No Surprises Act as a guidepost for arbitrators, may benefit from considering commercial payment differences across independent anesthesiologist, independent CRNA, or anesthesiologist-CRNA dyad provider structures. ■

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Authorship Information: Concept and design (ELD, BL, LA, ET); acquisition of data (LA, ET); analysis and interpretation of data (ELD, BL, LA, ET); drafting of the manuscript (ELD, BL); critical revision of the manuscript for important intellectual content (ELD, LA, ET); statistical analysis (BL); obtaining funding (LA, ET); and supervision (ET).

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Supplemental Material

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- B. Medicare Advantage Claims
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- B. Sensitivity Analyses

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eAppendix 4. Cost-sharing and Network Status in MA Plans

eAppendix 5. Distributions of Allowed Amounts and Charges

eAppendix 1. Detailed Inclusion Criteria

A. Commercial Claims

Our analytic sample includes commercial claims for the ten most common professional anesthesiology services in HCCI data among commercial payers in outpatient hospital and ambulatory surgery center (ASC) places of service in 2016-2017. Within the outpatient and ASC settings, these ten most common anesthesia procedure codes account for 60.1% of anesthesia commercial claims in the HCCI data for 2016-2017. The procedure codes included in our analytical sample are presented in Appendix Exhibit 1.1.

We identified 4.5 million commercial claims for these ten procedure codes in the HCCI data for 2016-2017 at an outpatient or ASC setting. After data exclusions (detailed below), there are 3.59 million commercial claims in our analytical sample.

B. Medicare Advantage Claims

Our analytical sample also includes Medicare Advantage (MA) claims for the same ten professional anesthesiology services. Within the outpatient and ASC settings, these ten most common anesthesia procedure codes account for 65% of anesthesia MA claims in the HCCI data for 2016-2017. The procedure codes included in our analytical sample are presented in Appendix Exhibit 1.1.

We identified 2.7 million MA claims for these ten procedure codes in the HCCI data for 2016-2017 at an outpatient or ASC setting. After data exclusions (detailed below), there are 1.87 million MA claims in the sample.

C. Data Exclusions

We identified and excluded the following data issues from our analytical sample:

1. Claims for patients with unhealthy conditions. These are identified based on modifiers.¹
2. Claims where the provider type cannot be determined because the modifiers are missing.
3. Scenarios where there are more than two claims identified for the same patient on the same service date for the same procedure code.²
4. Scenarios where the provider identification is inconsistent with the number of claims identified. These include the following: 1) modifier on claim indicates that procedure was personally performed by an anesthesiologist or CRNA but there are two claims identified in the data for that procedure; or 2) modifier on claim indicates the

¹ The modifiers are P3, P4, P5 and P6. These claims were excluded because of inconsistency in whether or not additional units for patient health were incorporated into the reported units on claims.

² We assumed that if the anesthesia procedure was performed by anesthesiologist-CRNA supervisory dyad, then there should be only two claims filed (one from the anesthesiologist and one from the CRNA).

procedure was performed by anesthesiologist-CRNA supervisory dyad but there is only one claim identified in the data for that procedure.

5. Other data anomalies include 1) claims with missing provider zip codes; 2) claims where the providers are located in US Territories; 3) claims with inconsistent values for network indicator or place of service across claim lines; 3) claims with zero or negative values for charges or allowed amounts; and 4) scenarios where the anesthesiologist supervised more than four concurrent procedures (modifier = AD).
6. Claims where the charge or allowed amount is three standard deviation from the mean.

eAppendix Exhibit 1.1. Anesthesia Procedures Included in Analysis

CPT Code	Description	Commercial		Medicare Advantage	
		# of Claims	% of Sample	# of Claims	% of Sample
00810	Anesthesia for lower intestinal endoscopic procedures	1,490,635	41.6%	675,065	36.1%
00740	Anesthesia for upper gastrointestinal endoscopic procedures	573,726	16.0%	308,141	16.5%
00142	Anesthesia for procedures on eye; lens surgery	291,984	8.1%	615,310	32.9%
01400	Anesthesia for surgical arthroscopic procedures on knee joint	242,007	6.7%	37,276	2.0%
00840	Anesthesia for procedures on the lower abdomen	234,875	6.6%	29,415	1.6%
00170	Anesthesia for intraoral procedures, including biopsy	171,309	4.8%	3,379	0.2%
01480	Anesthesia for procedures on bones of lower leg, ankle, and foot	151,764	4.2%	43,440	2.3%
01810	Anesthesia for procedures on the forearm, wrist and hand	144,866	4.0%	60,947	3.3%
00400	Anesthesia for procedures on the thorax	143,460	4.0%	56,168	3.0%
00790	Anesthesia for procedures on the upper abdomen	140,898	3.9%	38,781	2.1%
Total		3,585,524	100%	1,867,922	100%

Source: Authors' Analysis of 2016-2017 HCCI commercial and Medicare Advantage claims data.

eAppendix 2. Conversion Factor Methodology

A. Conversion Factor and Medicare Ratio Calculations

Conversion Factors

The conversion factors based on billed charges and allowed amounts for independent anesthesiologists and CRNAs are calculated as follows:

1. Charges CF = Charge / (base units + time units)
2. Allowed Amount CF = Allowed Amount / (base units + time units)
3. The base units are determined by CMS for each procedure code and are available online by year.³
4. The time units are pulled from the “units” variable in the claims data.
5. Since we excluded unhealthy patients from our sample, we do not need to account for the patients’ health in our conversion factor calculations.

The conversion factors based on allowed amounts for Anesthesiologist-CRNA supervisory dyad⁴ are calculated as:

1. Allowed Amount CF = (Allowed Amount *2) / (base units + time units)
2. The conversion factors corresponding to billed charges cannot be calculated for medically directed procedures. It is not clear in our data whether the charges in the claims are divided in half amongst the anesthesiologist and CRNA. It appears that in some instances the charges have been divided in half in the claims, whereas in other instances, it appears that they both applied their full charges.

Comparison to Traditional Medicare

The charge and allowed amount conversion factors are compared to traditional Medicare using the anesthesia conversion factors published by CMS.⁵ The Medicare conversion factors are merged to the claims data based on zip codes and year. The national average Medicare conversion factor based on data published by CMS is \$22.31 for the 2016-2017 time period.⁶ The percentages of allowed amount CF and charge CF to traditional Medicare are calculated at the claim level.

³ The base units for the anesthesia CPT codes are available online at <https://www.cms.gov/Center/Provider-Type/Anesthesiologists-Center>

⁴ This calculation is based on CMS payment policy, and there is also documentation that this is the computation used in the commercial market by UnitedHealthcare; accessed June 2020, URL: <https://www.uhcprovider.com/content/dam/provider/docs/public/policies/comm-reimbursement/COMM-Anesthesia-Policy.pdf>

⁵ The anesthesia conversion factors are available online at <https://www.cms.gov/Center/Provider-Type/Anesthesiologists-Center>

⁶ The national average Medicare conversion factors are calculated based on CMS anesthesia conversion factors data at the locality level.

B. Sensitivity Analyses

Commercial Claims

More than 50% of commercial claims in our analytical sample have unit values of 1 across all procedure codes. It is unclear in our data whether the unit value of 1 represents 15 minutes or if that is the default value if the time units are not available.

The mean in-network allowed amount CFs are consistently higher for claims with unit values of 1 than for claims with unit values greater than 1. The discrepancies are larger for some procedure codes than others (Appendix Exhibit 2.1). We do not see this discrepancy when comparing mean in-network allowed amounts for these two group of claims (unit values of 1 versus unit values greater than 1) (Appendix Exhibit 2.1).

If we include claims with unit values of 1, we may inadvertently cause an upward bias in the conversion factor calculations. As a conservative resolution to this data issue, we use a subset of claims where the unit values are not equal to 1 for our primary analyses pertaining to conversion factors.

To assess the sensitivity of our analyses to this exclusion criteria, we repeated our conversion factor analyses using the mean and median units of each procedure codes from the MA claims as a proxy for the time units for the commercial claims where the unit values are equal to 1.

Appendix Exhibit 2.2 compares the mean in-network and out-of-network conversion factors across three samples: 1) conversion factors from our primary analysis based on subset of commercial claims with unit values not equal to 1; 2) all commercial claims where the mean units from MA claims are used as a proxy for time when the unit value is 1; and 3) all commercial claims where the median units from MA claims are used as a proxy for time when the unit value is 1.

Of the three samples, the conversion factors calculated from our primary analysis are the most conservative for all provider types. For independent anesthesiologists, the mean in-network allowed amount CF are pretty aligned across the three samples. The mean ranges from \$82 to \$88. For independent CRNAs, there is minimal variation in the mean in-network allowed amount CFs across the three samples. The mean ranges from \$57 to \$70. For anesthesiologist-CRNA supervisory dyads, there is some variation in the mean in-network allowed amount CF across the three samples. The mean ranges from \$65 to \$82 for anesthesiologists-supervisors and \$60 to \$77 for CRNAs supervisee.

Notably, our empirical analysis of 2016-2017 commercial claims estimated a mean commercial in-network allowed amount CF (\$82) for direct anesthesiologists' services slightly higher than that self-reported by a convenience sample of anesthesiologists in the American Society of Anesthesiologists' annual survey (\$79 in 2017).⁷

Medicare Advantage Claims

Approximately 30% of MA claims in our analytical sample have unit values of 15 or more. It appears that the unit values in our data may be a mix of 15-minute increments and actual minutes. The mean in-network allowed amount CF for MA claims with unit values of 15 or more are much lower than the MA claims with unit values of 10 or less. After converting the unit values of 15 or more to 15-minute increments, the mean in-network allowed amount CF

⁷ Stead S, Merrick SK. ASA Survey Results for Commercial Fees Paid for Anesthesia Services – 2017. ASA Monitor, 2017; 81(10):64-71. (Accessed 06/07/2020) URL: <https://monitor.pubs.asahq.org/article.aspx?articleid=2654730>

for this set of claims are aligned with the claims with unit values of 10 or less (Appendix Exhibit 2.3).

Approximately 3.4% of MA claims in our sample have unit values of 10 to 14.99. It is unclear whether these values represent 15-minute increments or actual minutes for the procedures.

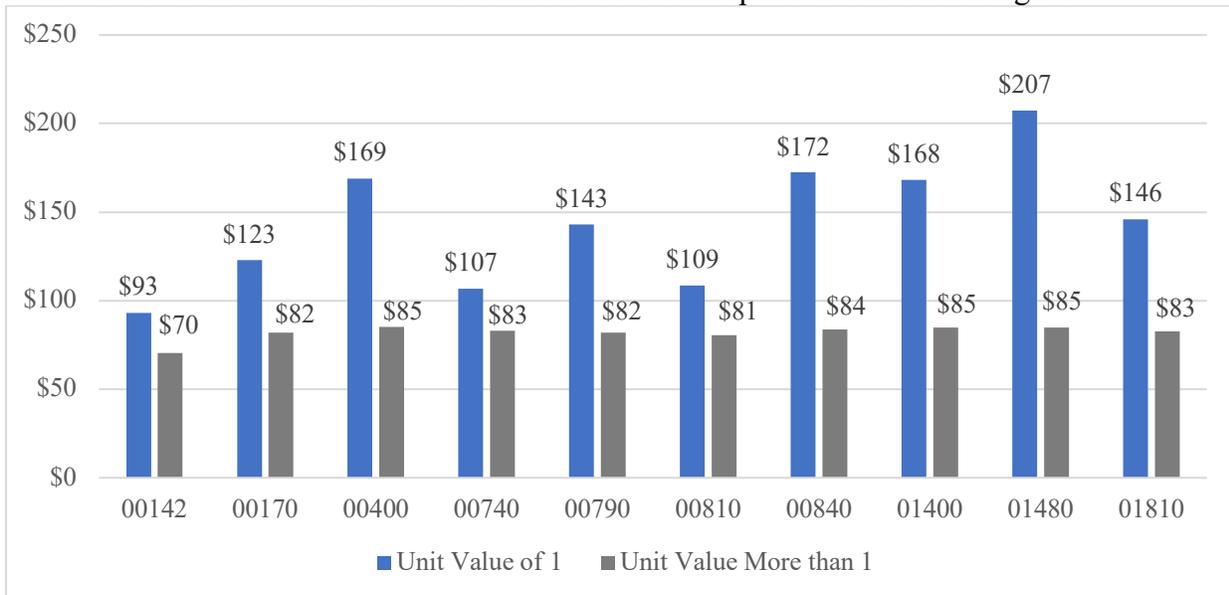
For the subset of MA claims with unit values of 10 to 14.99, the mean in-network conversion factors seem reasonable for some procedure codes but not for others after converting the units to 15-minute increments. For instance, for procedure code 00142, the mean in-network conversion factor for independent anesthesiologists before adjusting the units is \$6.19. After adjusting the units to 15-minute increments, the mean in-network conversion factor is \$20.30. This also holds true for procedure code 00810, where the pre-adjusted mean in-network conversion factor for anesthesiologist is \$8.57. After adjusting the units, the mean in-network conversion factor is \$24.83.

There are some procedure codes where converting the units to 15-minute increments may not make sense for this group of claims. For instance, for procedure code 00400, the mean in-network conversion factor for anesthesiologist before adjusting the units is \$16.95. After converting the units to 15-minute increments, the mean in-network conversion factors increased to \$63.96. This is also true for procedure codes 00170, 00840, 01400, 01480 and 01810 (Appendix Exhibit 2.3).

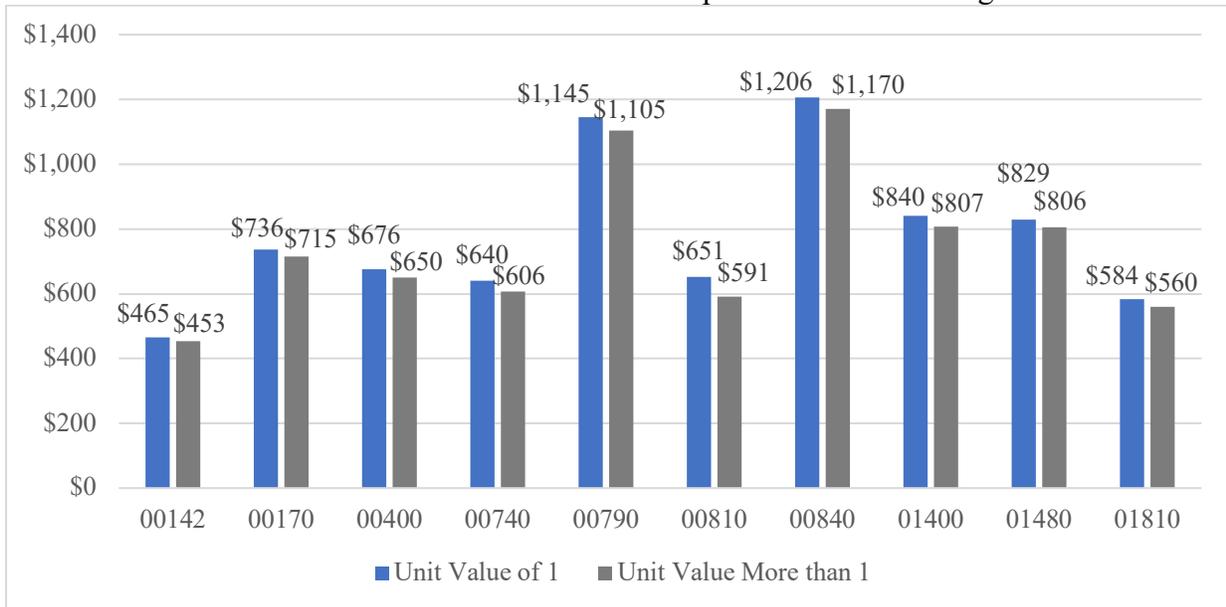
To resolve this issue, we exclude MA claims with unit values of 10 to 14.99 from the conversion factor calculations.

eAppendix Exhibit 2.1. Comparison of Allowed Amount CF and Total Allowed Amounts for Commercial Claims with Unit Values of 1 and Greater than 1

Panel A. Mean In-Network Allowed Amount CF for Independent Anesthesiologists



Panel B. Mean In-Network Allowed Amounts for Independent Anesthesiologists

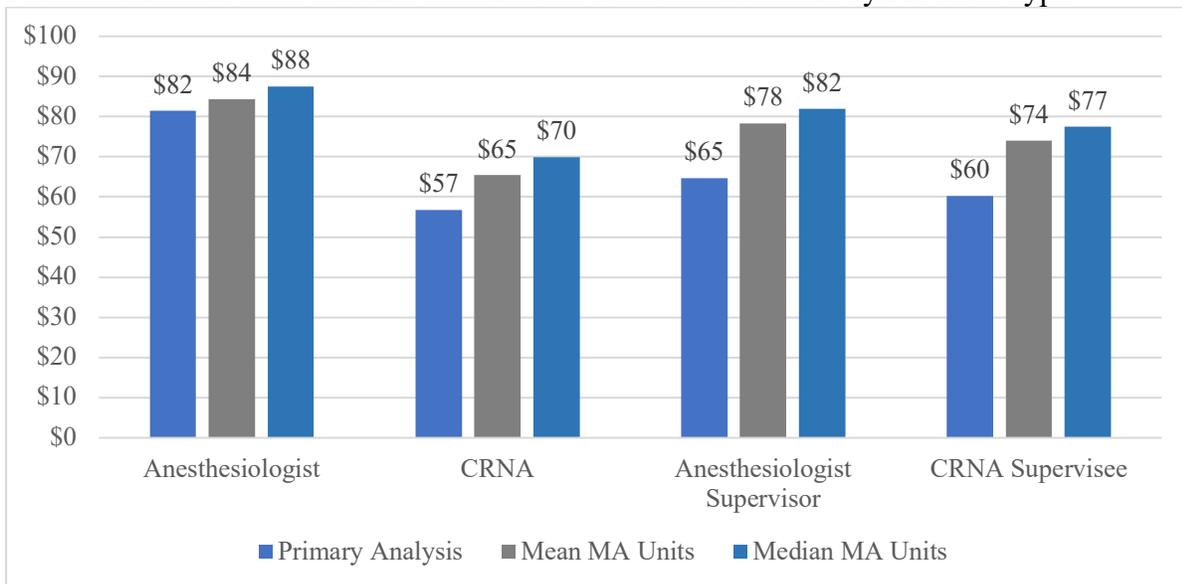


Source: Authors' Analysis of 2016-2017 HCCI commercial claims data.

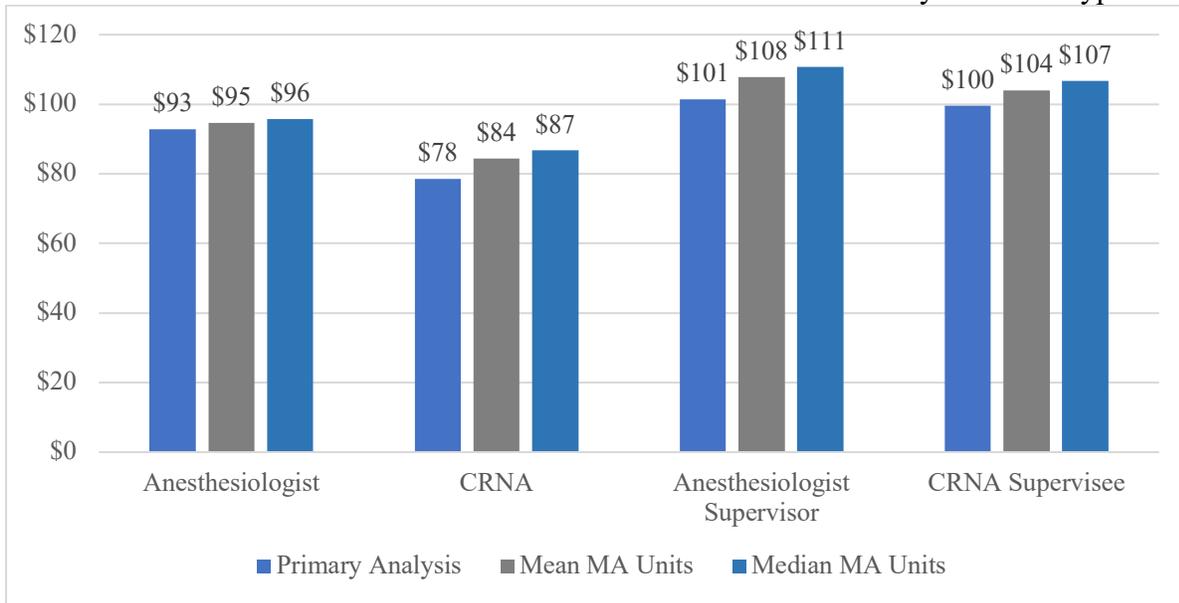
Note: This pattern is also consistent for independent CRNAs and Anesthesiologists-CRNA supervisory dyads.

eAppendix Exhibit 2.2. Sensitivity Analysis

Panel A. Mean In-Network Allowed Amount Conversion Factors by Provider Type



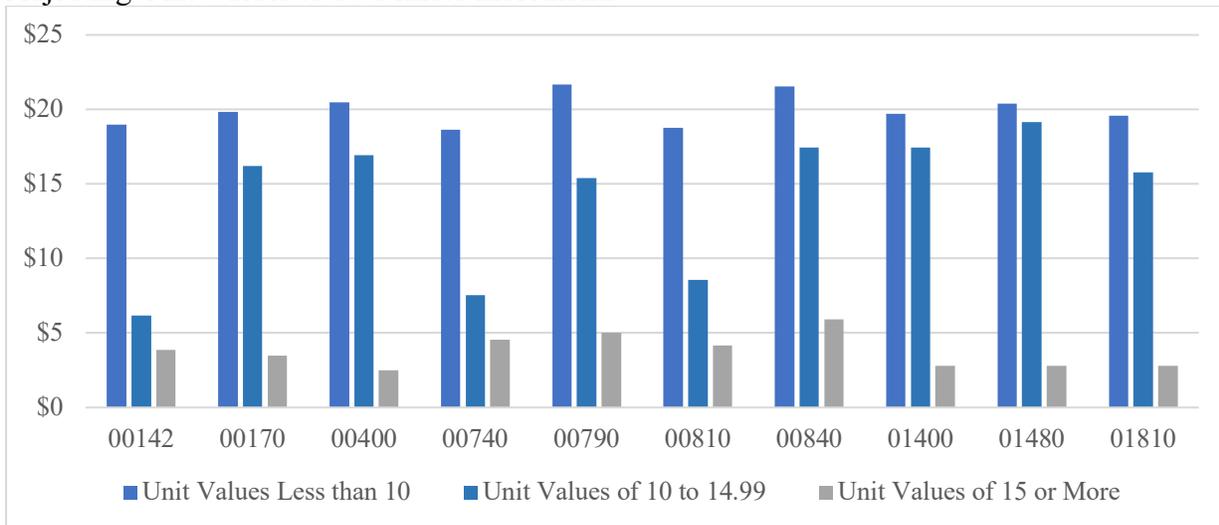
Panel B. Mean Out-of-Network Allowed Amount Conversion Factors by Provider Type



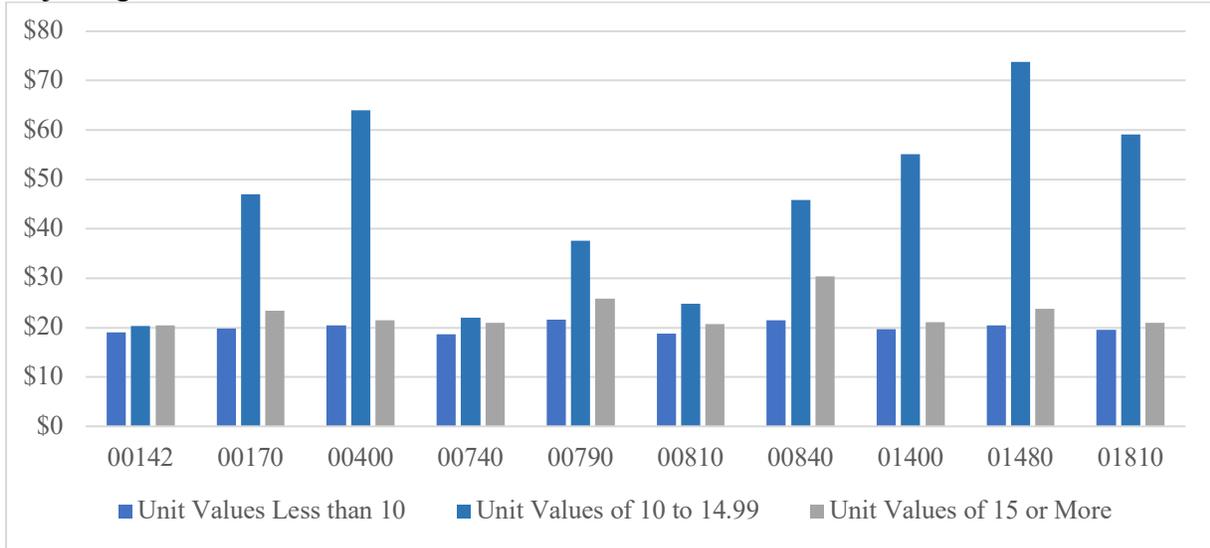
Source: Authors' Analysis of 2016-2017 HCCI commercial and Medicare Advantage claims data.

eAppendix Exhibit 2.3. Comparison of Allowed Amount CF for MA Claims with Unit Values Less than 10, 10-14.99 and 15 or More

Panel A. Mean In-Network Allowed Amounts CF for Independent Anesthesiologists; Before Adjusting Unit Values to 15-Minute Increments



Panel B. Mean In-Network Allowed Amounts CF for Independent Anesthesiologists; After Adjusting Unit Values to 15-Minute Increments



Source: Authors' Analysis of 2016-2017 HCCI Medicare Advantage claims data.

eAppendix 3. Provider Structure Categorization

Procedure Identification

Claims with the same patient identifier, procedure code, place of service, and service date are assumed to be associated with the same anesthesia procedure for the patient.

Provider Type

The type of provider(s) performing the anesthesia procedure are determined using the modifiers and “provcats” variable provided by HCCI (that attempts to identify the provider’s primary specialty). If the modifiers are missing, then the provcat variable is used as the proxy.

The provider type identified for each procedure are based on the following rules:

1. Anesthesiologist - The procedure has one claim and the modifier is AA (Performed personally by an anesthesiologist).
2. CRNA - The procedure has one claim and the modifier is QZ (CRNA service without medical direction by a physician).
3. Anesthesiologist-CRNA supervisory dyad - The procedure has two claims and one of the modifiers is QY or QK and the other modifier is QX.

The provider type was identified using modifiers for 90.8% of the commercial claims and 99.2% of the MA claims in our analytical sample.

The breakdown of the provider type in our analytical sample is presented in Appendix Exhibit 3.1.

eAppendix Exhibit 3.1. Provider Structure Composition

Provider Type	Description	Commercial		Medicare Advantage	
		# of Procedures	% of Procedures	# of Procedures	% of Procedures
ANES-CRNA	Anesthesiologist-CRNA (medical direction by the physician)	553,248	18.2%	365,108	24.3%
ANES	Anesthesiologist (personally performed)	1,319,606	43.5%	413,302	27.5%
CRNA	CRNA (without supervision)	1,159,422	38.2%	724,404	48.2%
Total		3,032,276	100%	1,502,814	100%

Source: Authors' Analysis of 2016-2017 HCCI commercial and Medicare Advantage claims data.

eAppendix 4. Cost-sharing and Network Status in MA Plans

We observed that out-of-network anesthesiology service utilization was much higher among MA plan claims (41.2%) than commercial claims (8.3%) (Appendix Exhibit 4.1). Prior work by Daria Pelech has also documented higher rates of out-of-network utilization among MA plans than commercial plans.⁸

This high out-of-network anesthesiology service utilization raised concerns about the potential for high out-of-pocket expenditures for the MA plan enrollees. We evaluated the cost-sharing burden for MA plan enrollees as the sum of co-payment, co-insurance, and deductible amounts reported on claims in our analytic sample. Average cost-sharing for MA patients for the anesthesiology services included in our analysis is \$12.51 (8.5% of the allowed amount) for out-of-network services, compared with \$5.47 (3.6% of the allowed amount) for in-network services. We conclude that high out-of-network anesthesiology service utilization does not result in substantial out-of-pocket burden for MA plan enrollees.

eAppendix Exhibit 4.1. Network Status for Anesthesia Services among Commercial and Medicare Advantage Claims

Network Status	Commercial				Medicare Advantage			
	Anesthesiologist-CRNA Dyad	Anesthesiologist	CRNA	Total	Anesthesiologist-CRNA Dyad	Anesthesiologist	CRNA	Total
In-Network	86.7%	87.7%	81.9%	85.3%	53.3%	61.0%	60.3%	58.8%
Out-of-Network	5.7%	7.4%	10.4%	8.3%	46.7%	39.0%	39.7%	41.2%
Unknown	7.6%	4.8%	7.7%	6.4%	0.0%	0.0%	0.0%	0.0%

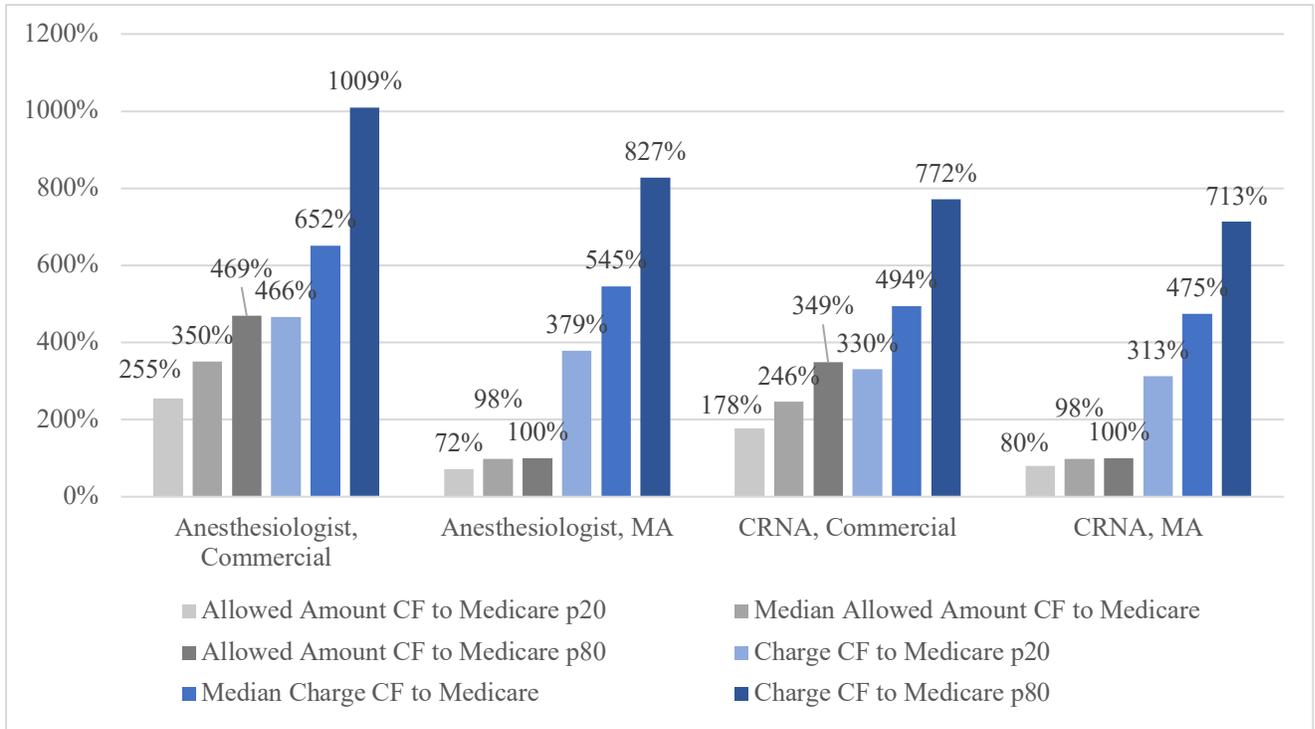
Source: Authors' Analysis of 2016-2017 HCCI commercial and Medicare Advantage claims data.

Note: There are no unknown network status for Medicare Advantage claims in our data sample. Anesthesiologist-CRNA dyads are considered out-of-network if either the anesthesiologist or the CRNA (or both) is out-of-network. If one provider has unknown network status but the other has in-network status, the dyad's network status is considered unknown.

⁸ Daria M. Pelech. Prices for Physicians' Services in Medicare Advantage and Commercial Plans. *Medical care Research and Review*. 2018;77(3):236-248. URL: <https://doi.org/10.1177/1077558718780604>

eAppendix 5. Distributions of Allowed Amounts and Charges

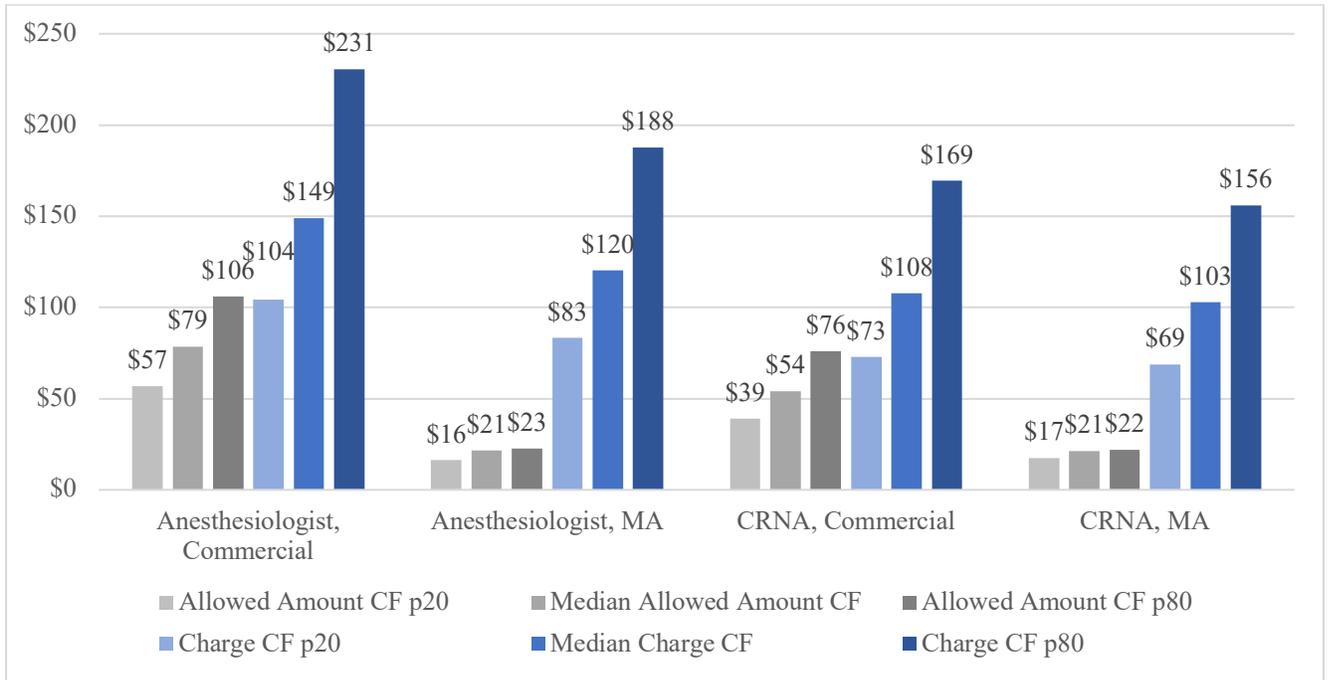
eAppendix Exhibit 5.1. Distribution of Percentage of Allowed Amount and Charges Conversion Factors Relative to Traditional Medicare



Source: Authors' Analysis of 2016-2017 HCCI commercial and Medicare Advantage claims data.

Note: The allowed amount and charge conversion factors include in-network, out-of-network, and unknown network status claims and exclude claims for anesthesiologist-CRNA supervisory dyads.

eAppendix Exhibit 5.2. Distribution of Allowed Amount and Charges Conversion Factors among Commercial and MA Claims



Source: Authors' Analysis of 2016-2017 HCCI commercial and Medicare Advantage claims data.

Note: The allowed amounts and charges includes in-network, out-of-network, and unknown network status claims and exclude claims for anesthesiologist-CRNA supervisory dyads.