Estimated Cost Effectiveness for Inpatient Anesthesia Services in Tennessee

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Purpose: The purpose of this report is to illustrate the cost effectiveness of CRNAs for inpatient anesthesia services in Tennessee. This analysis adapted a previously published method to simulate cost effectiveness for anesthesia services.

Introduction: Certified Registered Nurse Anesthetists (CRNAs) work in a variety of anesthesia delivery models. In some states, CRNAs may provide anesthesia services independently without physician medical direction or supervision. Additionally, there are 17 states that have opted-out of the Centers for Medicare & Medicaid Services (CMS) federal physician supervision rule.[1] There are currently more CRNAs working in the state of Tennessee than anesthesiologists . In 2013 the total population for the state of Tennessee was 6,495,978 .[2] According to the 2012-2013 Area Resource File (ARF) [3], there are a total of 1,574(67%) CRNAs in practice, and a total of 781(33%) anesthesiologists in practice.

Methodology: According to Hogan et al., a stochastic simulation model "simulates likely costs and revenues associated with each delivery model, holding constant other conditions likely to affect costs and revenues in the comparisons".[4] This analysis implemented variables related to average inpatient procedures as found in the 2010 *Nursing Economic$* study[4], and references hospital payer mix proportions and salary factors applicable to Tennessee for revenue and cost. Table 1 depicts the key parameters held constant in this simulation. Anesthesia revenue was calculated using the Medicare billing rules for anesthesia based on anesthesia base and time units by anesthesia conversion factor. To make revenue specific for Tennessee, conversion factors[4-6] and payer proportions[7] were identified for the state. Inpatient demand has been defined as four anesthetics per inpatient operating room, and 12 inpatient operating rooms per facility.[4] Additionally, annual revenue calculations excluded weekend days (i.e., 104 days) within the year to represent average procedure days. Finally, Hogan and colleagues used anesthesia salary to derive anesthesia cost.[4] Similarly, we used anesthesia salary obtained from the MGMA Physician Compensation and Production Survey and the AANA CRNA Compensation and Benefits Survey to derive anesthesia cost for the Southeast region.[8,9] When appropriate, the Bureau of Labor Statistics consumer price index calculator was used to account for inflation to represent dollar values for 2014.[10] As such, Table 2 simulates the potential revenue and cost for a variety of defined anesthesia delivery models for Tennessee acute care hospitals while taking into account weeks not working (i.e., paid time off, holiday, vacation and sick time) by anesthesia providers. Weeks not working per year were derived from both the AANA CRNA Compensation and Benefits Survey and the MGMA Physician Compensation and Production Survey, of which both CRNAs and anesthesiologists did not work approximately 8 weeks in a 52 week year.[8,9]

Limitation: This analysis is unable to account for differences in either revenue or cost for Tennessee hospitals that vary in number of operating rooms, anesthesia provider employment arrangement (i.e., hospital contracted or employed), work hours, fringe benefits, stipends, payer mix, mixed provider models, procedures, and/or billing practices.

Table 1. Key Parameters Are Held Constant in Simulation

Payer parameters	Medicare	Medicaid	Private	Other
Tennessee payer proportion [a]	0.21	0.22	0.56	0.01
Conversion factors	$20.30[b]	$15.43[c]	$53.82[d]	$0
Mean value for Anesthesia Billing [d]	Anesthesia Base unit	Anesthesia Time unit		
	6.2	7.1		
No. of procedures per operating room [d]	4			
Annual procedure days	260			
Anesthesia provider	Salary [e]			
Anesthesiologist	$ 457,475			
CRNA	$ 168,000			

[a] Payer proportion was from 2012 Health Leaders / InterStudy; State Group Insurance Program 2011 Annual Report .[7] Other is equivalent to the self-pay group found in the *Nursing Economic$* study and is assumed to be non-revenue producers (i.e., unreimbursed). Workers Comp and Other government payers were not included in this analysis.
[b] Medicare 2012 conversion factor for Tennessee was identified from CMS.[5]
[c] The 2012 Medicaid conversion factor was obtained from averaging major healthcare billing companies in Tennessee.[6]
[d] Hogan et al. simulated factors regarding mean anesthesia value for anesthesia billing to determine average anesthesia base and time unit for inpatient setting. Additionally, it is presumed that 2008 private claims data was used to develop private conversion factor.[4] The private conversion factor was adjusted for 2012 using the Bureau of Labor Statistics CPI inflation calculator [10]
[e] MGMA 2012 Physician Compensation and Production Survey of 2011 data does not provide state level analysis, only Health and Human Service (HHS) region analysis.[8] The MGMA physician compensation in 2011 was adjusted for 2012 using the CPI inflation calculator [10] . HHS Region 4 includes median salary for Florida, Tennessee, Georgia, Alabama, Kentucky, North Carolina, South Carolina, and Mississippi. CRNA Salary is based on the 2011 AANA CRNA Compensation and Benefits Survey using 2010 data.[9] The median of the medians of CRNA Salary for HHS Region 4 was identified and this number was adjusted for 2012 using the CPI inflation calculator [10]

Table 2. Estimated Revenue and Cost in Dollars per Hospital to Sustain Anesthesia Services for Inpatient Operating Rooms Only

Anesthesia Delivery Model based on four procedures per OR	Number of Staff Needed to Sustain Anesthesia Services for 12 ORs*	Annual Total Revenue per hospital	Annual Total Costs per Hospital	(Revenue-Cost) per hospital	(Revenue-Cost) per OR
CRNA only	13.8 CRNAs	6,160,528.03	2,318,400.00	3,842,128.03	320,177.34
MDA only	13.8 MDs	6,273,217.89	6,313,156.38	-39,938.49	-3,328.21
Medical Direction 1:4	3.5MD/13.8CRNA	6,273,217.89	3,919,562.85	2,353,655.04	196,137.92
Medical Direction 1:2	6.9MD/13.8CRNA	6,273,217.89	5,474,978.19	798,239.70	66,519.97
Supervision 1:6	2.3MD/13.8CRNA	5,023,291.01	3,370,592.73	1,652,698.28	137,724.86

Note: As in the 2010 *Nursing Economic$* simulation[4], we assume an inpatient hospital has 12 operating rooms that perform 4 procedures a day using one of the defined anesthesia delivery models above. Annual total revenue excludes weekends (i.e., 260 procedure days). When assessing savings per operating room, model assumes average operating room volume (i.e., procedure per operating room) and payer mix are similar throughout state of Tennessee for any given inpatient operating room. All parameters held constant except for salary associated with a given anesthesia delivery model.
*According to the AANA 2011 CRNA Compensation and Benefits Survey CRNAs, the median sum of the top three paid days off per year was 8.2 weeks (i.e., weeks not working), or 43.8 weeks worked per year.[9] According to the MGMA 2012 Physician Compensation and Production Survey, the median number of weeks worked per year was 44 weeks for an anesthesiologist, or 8 weeks not working per year.[8]

Results: Table 2 illustrates the simulated demand for an acute care hospital in Tennessee and the revenue and costs associated with providing anesthesia services according to anesthesia delivery model for operating rooms only. Additionally, the simulation takes into account the staffing needs to *sustain* anesthesia services for a 12 operating room facility. When assessing profit per operating room, the model assumes average operating room volume (i.e., procedure per operating room) and payer mix are similar throughout Tennessee for any given inpatient operating room. When all parameters are held constant, the most cost effective anesthesia delivery model is the CRNA only model, yielding a potential profit of $3,842,128 for the hospital, or $320,177 per operating room. This is stark contrast with the MDA only model operating with the greatest non-sustainable loss of $-39,938 for hospital, or $-3,328 per operating

room. It should also be appreciated that in all models, with the exception of the two single provider models (i.e., CRNA only and MDA only) mentioned above, more anesthesia providers (e.g., 3.5 anesthesiologists and 13.8 CRNAs) would be needed to achieve the same production as the CRNA only model (e.g., 13.8 CRNAs), resulting in additional costs.

Conclusion: Based on this analysis, the most cost effective anesthesia delivery model is achieved when CRNAs deliver anesthesia services alone.

References

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