Kansas Academy of Anesthesiologist Assistants

January 13, 2022

Testimony of Spencer Jones, CAA
President, Kansas Academy of Anesthesiologist Assistants

Mr. Chairman and members, thank you for the opportunity to speak today regarding the practice of anesthesiologist assistants. My name is Spencer Jones, I am a certified anesthesiologist assistant, or CAA, practicing at Saint Luke's Hospital of Kansas City. I serve as President of the Kansas Academy of Anesthesiologist Assistants. Our core mission is to encourage policy makers and health care stakeholders to allow for safe CAA practice in Kansas.

KAAA and KSA support the opinion issued by the Kansas Board of Healing Arts that confirms the ability of anesthesiologists to delegate responsibilities to a CAA. CAAs currently practice in Texas and Michigan under delegatory authority, as permitted under their medical practice acts. KAAA also fully supports the passage of CAA licensure legislation. KAAA agrees with the following passage from the Board's June 2021 statement: "the Board also believes that a CAA licensure statute is ultimately preferable from a regulatory perspective to maximize the Board's ability to meet its broader statutory mandate of protecting the public."

I'd like to provide you with some background on the CAA profession. I will touch on our education, training, and how we practice with physician anesthesiologists. First, I'll share just a little of my story. I grew up in the Kansas City area, on the Kansas side, went to Saint Louis University for my undergraduate degree, and then returned to Kansas City for my Master's in Anesthesia at UMKC. I was always very attracted to the study of physiology and pharmacology, so anesthesia naturally aligned with my interests. I had contemplated medical school, but ultimately decided that administering anesthesia as a CAA alongside anesthesiologists could be just as rewarding. I graduated in 2014; at the time there were only three facilities in the Kansas City area utilizing CAAs, so I started my career in Albuquerque at the University of New Mexico Hospital, the state's only level one trauma center, meaning we saw a large volume of high acuity surgical patients. The experience was extremely beneficial and I enjoyed my time there, but I always planned to return home to Kansas if I could. I was able to get pretty close in 2017, when I took a position at Saint Luke's, just a mile into Missouri. Saint Luke's Physician Group employs the anesthesia staff for Saint Luke's Hospital of Kansas City (plaza location), as well as Saint Luke's South Hospital, just off 69 Highway, in Kansas. So, we have anesthesiologists and anesthetists that float between the two locations, depending on surgical volume and staffing needs. CRNAs have been the only group of anesthetists that the department has been able to utilize at Saint Luke's South, because up until last summer it was not clear that CAAs could practice in Kansas under delegatory authority. CRNAs and CAAs have identical scope of practice in our health system, yet CAAs have only been able to practice in our Missouri location due to geographic constraints. Children's Mercy Hospital is another example of an anesthesia group with locations on either side of the state line, but only the ability to utilize CRNAs at their Kansas location.

CAA programs were developed by anesthesiologists who saw the need for a new type of mid-level provider; the profession has existed for around 50 years. There are 12 CAA programs in the U.S. that graduate over 300 fresh AAs every year, as well as five new programs seeking accreditation this year. The first programs were launched at Emory University in Atlanta and Case Western Reserve University in Cleveland. An accredited anesthesiologist assistant educational program must be supported by an anesthesiology department of a medical school that is accredited by the Liaison Committee on Medical Education or its equivalent.

CAAs must obtain a Baccalaureate degree from a regionally accredited college or university in the U.S. or Canada and complete pre-medical course work, similar to that of a medical school student, to gain admission to an AA program. The AA curriculum is based on an advanced graduate degree model. All current programs are 24 to 28 months and graduates from all AA educational programs earn a Master's Degree. An average of 600 hours of classroom/laboratory education, 2600 hours of clinical anesthesia education, and more than 600 anesthetics administered, including all types of surgery, are typically required to successfully complete AA training.

CAAs currently practice in 17 states (including the neighboring states of Missouri, Oklahoma, and Colorado), the District of Columbia and Guam. There are approximately 3000 CAAs practicing in the US. CAAs practice in what's called the Anesthesia Care Team Model, meaning we always work under the supervision of an anesthesiologist.

In states where CAAs practice, we work alongside nurse anesthetists and have the same scope of practice as CRNAs. At Saint Luke's, we function as interchangeable parts of a highly skilled department, relieving each other for lunch breaks and at the end of shifts. CAAs practice in the Medicare system and the Centers for Medicare & Medicaid Services (CMS) define both CAAs and CRNAs as qualified non-physician anesthetists. The main difference between CAA and CRNA practice is that in states where Governors have opted out of Medicare supervision requirements, CRNAs are able to practice without being supervised by a physician. This distinction is not due to a difference in skill level or what we are trained to do; it's a matter of whether supervision is required. CAAs always have, and always will, practice under the supervision of a physician anesthesiologist. KAAA and our national organization, the American Academy of Anesthesiologist Assistants, believe that the Anesthesia Care Team model, with a physician anesthesiologist directly involved in anesthetic management, is the safest practice and provides for the highest level of care for our patients.

KAAA has provided you with some materials that I'll briefly touch on.

- The American Society of Anesthesiology, in their Statement Comparing Anesthesiologist Assistant and Nurse Anesthetist Education and Practice concluded that:

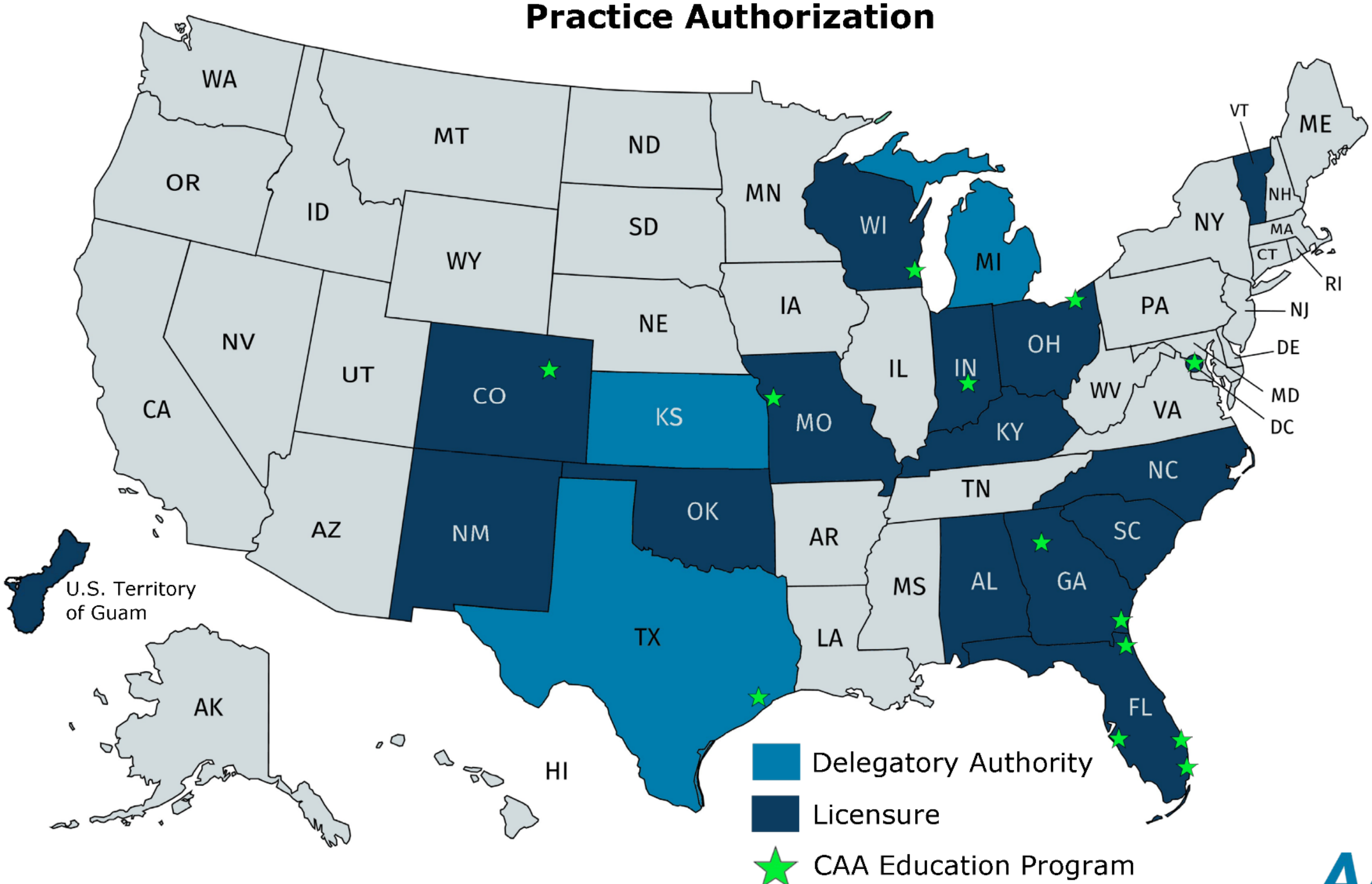
  "Differences do exist between anesthesiologist assistants and nurse anesthetists with regard to the educational program prerequisites, instruction, and requirements for supervision in practice as well as maintenance of certification. These are the result of the different routes that the two professions took toward development, and the stated preference of anesthesiologist assistants to work exclusively on teams with physician anesthesiologists. **None of these differences, in the opinion of the Committee, results in significant disparity in knowledge base, technical skills, or quality of care."**

- In a 2018 study of national claims data of 443,000 Medicare beneficiaries conducted by Stanford University professor Dr. Eric Sun, et al published in the journal Anesthesiology and entitled Anesthesia Care Team Composition and Surgical Outcomes, researchers found that:

  "To inform policymaking regarding the scope of anesthesiologist assistant practice, we compared outcomes between care teams with nurse anesthetists to care teams with anesthesiologist assistants for elderly patients undergoing inpatient surgery**. Our study found no statistically significant difference in outcomes of mortality, length of stay, and spending between these two types of care teams."**

Thank you for the opportunity to speak to you today. If you would like any additional information about the CAA profession, KAAA is happy to provide you with supplementary materials.

Certified Anesthesiologist Assistants
Practice Authorization



Updated June 2021

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Scope of Practice

Certified Anesthesiologist Assistants (CAAs) practice in the Anesthesia Care Team (ACT) with Physician Anesthesiologist oversight. The scope of clinical practice for CAAs is identical to that of nurse anesthetists working in the ACT.

The scope of practice of CAAs is determined by the following:

- The Physician Anesthesiologist or Practice Group
- The hospital credentialing body
- The state's board of medicine
- Any applicable state statute or regulation

Job Description

CAAs provide anesthesia care under the supervision and delegation of a qualified physician anesthesiologist. This allows physician anesthesiologists to use their medical education more efficiently and effectively.

CAAs gather patient data, perform patient evaluation, and administer and document the therapeutic plan designed for the anesthetic care of the patient. The tasks performed by CAAs reflect regional variations in anesthesia practice and state regulatory factors.

The physician anesthesiologist responsible for the CAA is available to prescribe and direct particular therapeutic interventions.

Under the direction of a physician anesthesiologist, in agreement with the ASA Statement on the Anesthesia Care Team (ACT) and in accordance with the AAAA Statement on the ACT, the CAAs' functions include, but are not limited to, the following:

- Developing and implementing an anesthesia care plan for a patient
- Obtaining a comprehensive patient history and performing relevant elements of a physical exam
- Performing preoperative and post-operative anesthetic evaluations and maintaining patient progress notes
- Ordering and performing preoperative patient consultations
- Ordering preoperative medications, including controlled substances, which may be administered before the supervising anesthesiologist cosigns
- Changing or discontinuing a medical treatment plan after consulting with the supervising anesthesiologist
- Obtaining informed consent for anesthesia or related procedures
- Ordering the perioperative continuation of current medications, which may be administered before the supervising anesthesiologist cosigns

- Pretesting and calibrating anesthesia delivery systems and obtaining and interpreting information from the systems and from monitors
- Implementing medically-accepted monitoring techniques
- Performing basic and advanced airway interventions, including, but not limited to, endotracheal intubation, laryngeal mask insertion and other advanced airways techniques
- Establishing peripheral intravenous lines, including subcutaneous lidocaine use
- Performing invasive procedures, including, but not limited to arterial lines, central lines, transesophageal echocardiograms, and Swan Ganz catheters
- Performing general anesthesia, including induction, maintenance, emergence and procedures associated with general anesthesia, such as gastric intubation
- Administering anesthetic drugs, adjuvant drugs, and accessory drugs
- Administering vasoactive drugs and starting and titrating vasoactive infusions to treat patient responses to anesthesia
- Performing, maintaining, evaluating and managing epidural, spinal and regional anesthesia including catheters
- Performing monitored anesthesia care
- Obtaining venous and arterial blood samples
- Administering blood, blood products, and supportive fluids
- Performing, ordering and interpreting appropriate preoperative, point of care, intra-operative or postoperative diagnostic tests or procedures
- Obtaining and administering perioperative anesthesia and related pharmaceutical agents, including intravenous fluids and blood products
- Managing the patient while in the preoperative suite, recovery area, or labor suites
- Ordering postoperative sedation, anxiolysis or analgesia, postoperative respiratory therapy and medicines to treat patient responses to anesthesia and ordering postoperative oxygen therapy, including initial ventilator therapy, ordering, which may be administered before the supervising anesthesiologist cosigns
- Initiating and managing cardiopulmonary resuscitation in response to a life-threatening situation
- Participating in administrative, research and clinical teaching activities including supervising student anesthesiologist assistants and other students involved in anesthesia education
- Performing such other tasks not prohibited by law that an anesthesiologist assistant has been trained and is proficient to perform

Professional Definition

Certified Anesthesiologist Assistants (CAAs) are highly-skilled health professionals who work under the delegation of licensed physician Anesthesiologists to implement anesthesia care plans. CAAs work exclusively within the Anesthesia Care Team model, as described by the American Society of Anesthesiologists (ASA).

The care team model expands the medical treatment provided by the physician Anesthesiologist and equips the medical facility to serve patients more effectively and efficiently by increasing access to care.

CAAs train and work under the supervision of physician Anesthesiologists, who retains responsibility for the immediate care of the patient.

Education Requirements

CAA education includes a pre-medical undergraduate track, and graduate degree from an accredited CAA program. All CAAs complete a comprehensive didactic and clinical program at the graduate school level.

CAAs receive extensive training in the delivery and maintenance of quality anesthesia care as well as advanced patient monitoring techniques. CAAs perform such tasks as administering drugs, obtaining vascular access, applying and interpreting monitors, establishing and maintaining a patient's airway, and preoperative assessment.

History

In the early 1960s, anesthesiology leaders faced extreme staffing shortages. To meet growing demands and increasing complexity of anesthesia and surgery, three Anesthesiologists (Dr. Gravenstein, Dr. Steinhaus, and Dr. Volpitto) proposed the concept of an anesthesia technologist – the precursor to the modern CAA.

The physicians designed an educational program to build on undergraduate premedical training then earn a Master's degree in Anesthesiology. The concept became a reality in 1969 when the Emory University in Atlanta, Ga., became the first CAA training program. It was soon followed by a program at Case Western Reserve University in Cleveland, Ohio.

In 1989, the National Commission for Certification of Anesthesiologist Assistants (NCCAA) was established to create a national certification process. Today, the ASA fully supports CAAs and the expansion of CAA licensure and practice across the nation.

Recognized by Federal Government

CAAs may practice at any Veterans Affairs facility in all 50 states.

The federal Centers for Medicare and Medicaid Services (CMS) recognizes both CAAs and Certified Registered Nurse Anesthetists (CRNAs) as non-physician anesthesia providers. Similarly, commercial insurance payers make no distinction between the two anesthetist types with regard to payments for services provided under medical direction by a physician Anesthesiologist.

Scope of Practice

The scope of CAA clinical practice is identical to that of nurse anesthetists on the Anesthesia Care Team. The local scope of practice of CAAs is usually defined by the following:

- The medically supervising and delegating physican Anesthesiologist or their medical practice group
- The hospital credentialing body
- The state board of medicine
- Any applicable state statute or regulation.

Practice Locations

CAAs enjoy career pathways in a dynamic profession that continues to see exponential growth, as evidenced by the addition of new training sites and new states opening to CAA practice. States, territories, and districts in which CAAs work by license, regulation, and/or certification include:

- Alabama
- Colorado
- District of Columbia
- Florida
- Georgia
- US Territory Guam
- Indiana
- Kentucky
- Missouri
- New Mexico
- North Carolina
- Ohio
- Oklahoma
- South Carolina
- Vermont
- Wisconsin

CAAs are granted practice privilege through physician delegation in these states:

- Kansas
- Michigan
- Texas

If a state does not provide the legislative or delegatory option of CAA practice, consultation should take place with the state board of medicine or other governing body to explore the specific legal implications of CAA practice in your state. General information on the steps to establish CAA practice is available from the AAAA Director of State Affairs office (info@anesthetist.org) Additional information can be found at https://www.anesthetist.org/info

Standard: Organization and Staffing

The organization of Anesthesia services must be appropriate to the scope of the services offered. Anesthesia must be administered only by the following providers:

- A qualified physician Anesthesiologist
- A doctor of medicine or osteopathy (other than an Anesthesiologist)
- A dentist, oral surgeon, or podiatrist who is qualified to administer anesthesia under state law
- A CRNA, as defined in § 410.69(b) of the Federal Register, "who is under the supervision of the operating practitioner or of an Anesthesiologist who is immediately available if needed"
- A CAA, as defined in § 410.69(b) of the Federal Register, "who is under the supervision of an Anesthesiologist who is immediately available if needed."

Educational Program Requirements

An accredited anesthesiologist assistant educational program must be supported by an anesthesiology department of a medical school that is accredited by the Liaison Committee on Medical Education or its equivalent. The Anesthesiology department must have the educational resources internally or through educational affiliates that would qualify it to meet the criteria of the Accreditation Council for Graduate Medical Education (ACGME), or its equivalent, for sponsorship of an anesthesiology residency program.

Although the standards recognize the importance of a basic science education within a clinically oriented academic setting, it is also recognized that some of the supervised clinical practice components of the curriculum may be carried out in affiliated community hospitals that have the appropriate affiliation agreements specifying the requisite teaching faculty and staffing ratios for the clinical experience.

The AA curriculum is based on an advanced graduate degree model. All current programs are 24 to 28 months and graduates from all AA educational programs earn a Master's Degree. An average of 600 hours of classroom/laboratory education, 2600 hours of clinical anesthesia education, and more than 600 anesthetics administered, including all types of surgery, are typically required to successfully complete AA training.

Prerequisites

Baccalaureate degree from a regionally accredited college or university in the US or Canada*

- English
- General Biology with lab
- General Chemistry with lab
- Human Anatomy with lab
- Human Physiology with lab
- Advanced Statistics
- Organic Chemistry with lab
- Biochemistry
- General Physics (lab recommended)
- Calculus

Medical College Admissions Test (MCAT) or the Graduate Records Admission Test Examination (GRE).

*Please review training program websites for specific information regarding prerequisites.

Master of Science in Anesthesia Average Matriculant GPA			**U.S. Medical Schools Average Matriculant GPA**		
	Overall	**Science**		**Overall**	**Science**
2014	**3.48**	**3.56**	**2014**	*****	*****
2013	**3.42**	**3.51**	**2013**	**3.54**	**3.44**
2012	**3.50**	**3.57**	**2012**	**3.54**	**3.44**
2011	**3.52**	**3.63**	**2011**	**3.53**	**3.43**
2010	**3.48**	**3.56**	**2010**	**3.53**	**3.43**
2009	**3.49**	**3.65**	**2009**	**3.51**	**3.51**

www.aamc.org/data/facts/applicantmatriculant/ (Table 17)
*AAMC's GPA totals from 2014 are not yet available

Training Programs

- Emory University (Atlanta, GA)
- Case Western Reserve University (Cleveland, OH; Houston, TX; Washington, DC)
- Indiana University (Indianapolis, IN)
- Medical College of Wisconsin (Milwaukee, WI)
- Nova Southeastern University (Tampa, FL; Fort Lauderdale, FL)
- South University (Savannah, GA. West Palm Beach, FL)
- University of Colorado (Denver, CO)
- University of Missouri-Kansas City (Kansas City, MO)

The Commission on Accreditation of Allied Health Education Programs (CAAHEP) accredits AA training programs. The American Society of Anesthesiologists (ASA) is a CAAHEP member and participates in the accreditation processes for three health professions: Anesthesiologist Assistants, Respiratory Therapy and Emergency Medical Technician-Paramedic. CAAHEP is the largest accreditor in the health sciences field. In collaboration with its Committees on Accreditation, CAAHEP reviews and accredits over 2000 educational programs in 19 health science occupations and is recognized by the Council for Higher Education Accreditation.

Certification

The National Commission for Certification of Anesthesiologist Assistants (NCCAA) was founded in July 1989 to develop and administer the certification process for AAs in the United States. The NCCAA consists of commissioners representing the ASA and the American Academy of Anesthesiologist Assistants (AAAA) and includes physician and AA members (at-large). Graduates or senior students in the last semester of a CAAHEP-accredited AA educational program may apply for initial certification. Such a professional distinction is awarded to an AA who has successfully completed the Certifying Examination for Anesthesiologist Assistants administered by NCCAA in collaboration with the National Board of Medical Examiners (NBME). Certified AAs are permitted to use the designation CAA to indicate that they are currently certified.

The content for the Certifying Examination for Anesthesiologist Assistants is based on knowledge and skills required for anesthetist practice. NCCAA has contracted with NBME to serve as a consultant for the development and ongoing administration of the Certifying Examination. A Test Committee of Anesthesiologists and AAs is responsible for writing and evaluating test questions for the examinations. The first Certifying Examination was administered in 1992.

NCCAA maintains a database of Certified Anesthesiologist Assistants for verification of individual practitioners. Hospitals, practice groups, state boards and others may verify an individual AA's certification via a printed verification statement posted on the Verify Certification page of the NCCAA's web site, www.nccaatest.org/. The web site also contains additional information about the National Commission and about the certification process.

Recertification

AAs are granted a time-limited certificate after passing the initial examination. The process for recertification requires that a CAA submit documentation to NCCAA every two years that he/she has completed 40 hours of Continuing Medical Education (CME). In addition, every six years the practitioner must pass the examination for Continued Demonstration of Qualifications (CDQ). (Note: NCCAA has revised the CDQ exam schedule to phase in recertification from every 6 years to every 10 years.)

The CDQ examination was first administered in 1998, making CAAs the first anesthesia profession to require passage of a written examination as part of the recertification process. Failure to meet any of the above CME or examination requirements results in withdrawal of the CAA's certification.

Anesthesia Care Team Composition and Surgical Outcomes

Eric C. Sun, M.D., Ph.D., Thomas R. Miller, Ph.D., M.B.A., Jasmin Moshfegh, M.A., M.Sc., Laurence C. Baker, Ph.D.

CME This article has been selected for the Anesthesiology CME Program. Learning objectives and disclosure and ordering information can be found in the CME section at the front of this issue.

ABSTRACT

Background: In the United States, anesthesia care can be provided by an anesthesia care team consisting of nonphysician providers (nurse anesthetists and anesthesiologist assistants) working under the supervision of a physician anesthesiologist. Nurse anesthetists may practice nationwide, whereas anesthesiologist assistants are restricted to 16 states. To inform policies concerning the expanded use of anesthesiologist assistants, the authors examined whether the specific anesthesia care team composition (physician anesthesiologist plus nurse anesthetist or anesthesiologist assistant) was associated with differences in perioperative outcomes.

Methods: A retrospective analysis was performed of national claims data for 443,098 publicly insured elderly (ages 65 to 89 yr) patients who underwent inpatient surgery between January 1, 2004, and December 31, 2011. The differences in inpatient mortality, spending, and length of stay between cases where an anesthesiologist supervised an anesthesiologist assistant compared to cases where an anesthesiologist supervised a nurse anesthetist were estimated. The approach used a quasirandomization technique known as instrumental variables to reduce confounding.

Results: The adjusted mortality for care teams with anesthesiologist assistants was 1.6% (95% CI, 1.4 to 1.8) *versus* 1.7% for care teams with nurse anesthetists (95% CI, 1.7 to 1.7; difference −0.08; 95% CI, −0.3 to 0.1; $P = 0.47$). Compared to care teams with nurse anesthetists, care teams with anesthesiologist assistants were associated with non–statistically significant decreases in length of stay (−0.009 days; 95% CI, −0.1 to 0.1; $P = 0.89$) and medical spending (−\$56; 95% CI, −334 to 223; $P = 0.70$).

Conclusions: The specific composition of the anesthesia care team was not associated with any significant differences in mortality, length of stay, or inpatient spending. **(Anesthesiology 2018; 129:700-9)**

IN an effort to increase access and reduce healthcare spending, policymakers and researchers are considering alternative care models, such as the expanded use of nonphysician providers (*e.g.*, nurse practitioners and nurse anesthetists).[1–4] Increasing the use of nonphysician providers could reduce costs because, in many settings, they are paid less than physicians for similar services.[5] In addition, in the face of predicted physician shortages[6,7] the expanded use of nonphysician providers could increase access, particularly in underserved areas where physician recruitment is challenging,[8] although whether and to what extent there are shortages in the anesthesia workforce are unclear.[9] However, these potential benefits could be mitigated or even reversed if nonphysician providers are associated with lower quality care and/or more expensive practice patterns.[10] Legislation governing whether and how nonphysician providers are allowed to provide patient care (*e.g.*, scope of practice laws) is typically determined at the state level in the United States, and alteration of existing legislation is the subject of intense legislative debate in many states.

Editor's Perspective

What We Already Know about This Topic

- Both nurse anesthetists and anesthesiologist assistants work together with physician anesthesiologists as part of care teams
- It is unknown whether the specific anesthesia care team composition (physician anesthesiologist plus nurse anesthetist or anesthesiologist assistant) is associated with differences in perioperative outcomes

What This Article Tells Us That Is New

- Using national claims data for 443,000 Medicare beneficiaries, the influence of care team composition on inpatient mortality, inpatient length of stay, and inpatient spending was evaluated
- There were no significant differences in mortality, length of stay, or inpatient spending between the care team models

There are three types of anesthesia providers in the United States: anesthesiologists, who are physicians trained in the specialty of anesthesiology; nurse anesthetists; and

This article is featured in "This Month in Anesthesiology," page 1A. Corresponding article on page 627. Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are available in both the HTML and PDF versions of this article. Links to the digital files are provided in the HTML text of this article on the Journal's Web site (www.anesthesiology.org). This work was presented on May 5, 2017, in Washington, D.C., at the 63rd annual meeting of the Association of University Anesthesiologists.

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anesthesiologist assistants. Nurse anesthetists are nurses who receive additional training in anesthesiology through a nurse anesthetist school. Like physician assistants more generally, anesthesiologist assistants receive training in anesthesiology through an anesthesiologist assistant program at one of 11 universities. The main differences between the two groups fall into three areas: training, licensure, and scope of practice. Both nurse anesthetists and anesthesiologist assistants obtain advanced training in anesthesiology, but nurse anesthetist schools typically require candidates to have a Bachelor of Science in nursing, professional nursing experience, and a valid nursing license. By contrast, anesthesiologist assistant programs allow for any bachelor's degree, as long as certain course requirements are met. Licensing and certification requirements for nurse anesthetists are established by the state nursing board, whereas the state medical board is responsible for licensing and certifying anesthesiologist assistants.

Finally, there are differences in state-level legislation (*i.e.*, scope of practice laws) controlling whether and how anesthesiologist assistants and nurse anesthetists may provide patient care. Current laws allow for nurse anesthetist practice in all 50 states, whereas anesthesiologist assistants may practice in only 16 states and the District of Columbia. In addition, anesthesiologist assistants always provide care under the supervision of an anesthesiologist. For nurse anesthetists, the situation is more complex. In states that have not chosen to "opt out" of federal regulations requiring physician supervision of nurse anesthetists, nurse anesthetists must practice under the supervision of a physician, although not necessarily an anesthesiologist. In states that have opted out of federal regulations requiring physician supervision of nurse anesthetists (see appendix table A.1 in the Supplemental Digital Content, http://links.lww.com/ALN/B729), nurse anesthetists have the *de jure* ability to practice without any physician supervision, although even in these states, *de facto* supervision is common,[11] particularly because hospitals, insurers, patients, and surgeons may impose additional restrictions limiting the ability of nurse anesthetists to practice independently. The scope of practice laws that define the legal ability of nurse anesthetists and anesthesiologist assistants to provide care remain contested at the state level. For example, as of 2013, 17 states had chosen to opt out of federal regulations requiring physician supervision of nurse anesthetists, and the decision to opt out remains contentious in the remaining states.

Although opt out concerns the regulation of nurse anesthetists, in this article, we focus on scope of practice laws governing the use of anesthesiologist assistants. As previously noted, current legislation permits anesthesiologist assistant practice in 16 of 50 states and the District of Columbia, and there are ongoing efforts to increase the number of states where anesthesiologist assistants may practice. Arguments against expanding the number of states where anesthesiologist assistants may practice generally focus on the possibility that health outcomes may be worse when anesthesiologist assistants provide anesthesia care. Although the differences in training and background between nurse anesthetists and anesthesiologist assistants may make this a theoretical possibility, it should be noted that generally, nurse anesthetists and anesthesiologist assistants practice in the setting of an anesthesia care team consisting of a physician anesthesiologist who supervises an nurse anesthetist or anesthesiologist assistant. Thus, the presence of the supervising physician could mitigate any systemic differences in background and training between anesthesiologist assistants and nurse anesthetists.

Ultimately, whether anesthesia care teams with anesthesiologist assistants have poorer outcomes than care teams with nurse anesthetists is an empirical question, and to date, there have been no large-scale studies examining differences in outcomes between anesthesiologist assistants and nurse anesthetists.[12] Understanding whether the specific composition of the anesthesia care team (physician anesthesiologist plus nurse anesthetist or physician anesthesiologist plus anesthesiologist assistant) is associated with differences in outcomes could inform efforts to expand the number of states where anesthesiologist assistants can practice. Moreover, it could also help inform the broader debate over the proper regulation of nonphysician providers. In this study, we used a large data set of administrative health claims to evaluate the hypothesis that there would be differences in outcomes (mortality, length of stay, and costs) between care teams consisting of physician anesthesiologists and anesthesiologist assistants compared to care teams consisting of physician anesthesiologists and nurse anesthetists.

Materials and Methods

Data

The data used for this study consisted of health insurance claims for a random 20% sample of U.S. Medicare beneficiaries enrolled in the traditional fee-for-service Medicare plan. In the United States, Medicare is a public insurance program that primarily provides health insurance for the elderly (persons 65 yr or older), although the program also covers some younger persons with significant disabilities and those with end-stage renal disease. In 2010, more than 80% of Medicare beneficiaries consisted of persons ages 65 yr and older.[13] Generally speaking, Medicare beneficiaries can choose from either a traditional fee-for-service plan, for which the federal agency administering Medicare—the Centers for Medicare and Medicaid Services—is the primary payer, or they can choose to be enrolled in a managed healthcare plan. With the latter, Medicare essentially subcontracts out the provision of health care to private health insurers, who bear all the costs for an individual's care. Roughly two thirds of Medicare beneficiaries are enrolled in the traditional fee-for-service plan.[14] Health insurance claims data for beneficiaries enrolled in the traditional fee-for-service Medicare plan are available for researchers upon approval of a data use agreement with the Centers for Medicare and Medicaid Services and payment of required fees. The Medicare data are highly detailed and include information such as admission and discharge dates, discharge diagnosis codes that can be used to identify patient comorbidities, codes for any surgical procedures that were performed, and the total amounts spent during a given admission.

Sample

To construct our sample, we began by using the inpatient file to identify all inpatient admissions with a surgical diagnosis-related group that occurred: (1) between January 1, 2004, and December 31, 2011, and (2) in a state that allowed for anesthesiologist assistant practice during this study period (n = 2,602,686; see Supplemental Digital Content, http://links.lww.com/ALN/B729, appendix table A.1, for a list of these states). We then attempted to match the inpatient claim to a claim submitted by an anesthesia provider by identifying claims submitted by an anesthesiologist, nurse anesthetist, or anesthesiologist assistant that (1) had an appropriate procedure code (Current Procedural Terminology codes 00100 to 01999), (2) had a date of service corresponding to the date of the primary surgical procedure reported on the inpatient claim, and (3) were submitted for the same patient as the patient listed on the inpatient claim. Details on how we performed this match can be found in the data appendix (Supplemental Digital Content, http://links.lww.com/ALN/B729). Ultimately, we were able to find a match for 1,064,591 admissions. Our inability to find a match for nearly half of the surgical admissions is because many diagnoses classified as "surgical" do not always require surgery. For example, one common surgical diagnosis, small bowel obstruction, is often managed without surgery.[15] Moreover, not all surgeries receive care from an anesthesia provider.

From this set of admissions, we then applied several exclusion criteria. First, we excluded patients under 65 yr, to focus on the elderly Medicare population, and patients more than 89 yr, as many established quality measures impose this restriction (n = 223,884).[16] Second, we excluded cases in which the surgical procedure code was missing (n = 25,863). Third, we excluded cases where patient race or sex was unknown (n = 2,382), as well as cases with missing costs (n = 3). Fourth, because the goal of our study was to compare outcomes when anesthesiologist assistants and nurse anesthetists are supervised by physician anesthesiologists, we excluded cases where neither a nurse anesthetist nor anesthesiologist assistant was involved in the patient's care (*i.e.*, provision of care by a physician only; n = 296,511), as well as a small number of cases where both were involved in the patient's care (n = 84). In addition, because nurse anesthetists in opt-out states may potentially practice independent of supervision by an anesthesiologist, we excluded any cases that occurred in an opt-out state in the years after the enactment of opt out (n = 19,567; see appendix table A.1 for a list of the opt-out states and the year of enactment, http://links.lww.com/ALN/B729). Finally, we excluded any surgery types for which we had fewer than 100 observations (n = 31,204), as well as cases from any hospital with fewer than 100 observations (n = 21,995), resulting in a final sample of 443,098 cases representing 353 surgery types from 845 hospitals (see Supplemental Digital Content, http://links.lww.com/ALN/B729, appendix fig. A.1 for a flow chart providing further details on sample construction).

Outcomes

We evaluated three primary outcomes: inpatient mortality, inpatient length of stay, and inpatient spending. Death and length of stay were directly obtained from the claims data, with length of stay being defined as the number of days between the admission and discharge dates plus one (so that a patient admitted and discharged on the same day had a length of stay of one day). For inpatient spending, we summed the total amounts paid to the hospital for the given stay, as well as *all* spending on individual healthcare providers (*e.g.*, spending for the surgeon, the anesthesiologist, and any additional consultants) between the admission and discharge dates. Dollar amounts were adjusted to year 2016 dollars using the consumer price index.[17]

Exposure

Our main independent variable of interest was whether an anesthesiologist assistant or nurse anesthetist was part of the anesthesia care team. We identified this based on the anesthesia claim for the given procedure, which reports the specialty of the anesthesia provider (anesthesiologist, anesthesiologist assistant, or nurse anesthetist).

Additional Variables

We obtained a robust set of additional variables to adjust for potential confounding. First, race, age, and sex were directly obtained from the claims data. Second, using the diagnosis codes reported on the inpatient claim, we used previously described methods[18] to measure the presence of the medical comorbidities (*e.g.*, diabetes, hypertension) that are used to determine the Elixhauser index, an index that is frequently used for risk adjustment.[18,19] A list of the comorbidities we measured is provided in table 1. Finally, we used the primary International Classification of Diseases, Ninth Revision (ICD-9) procedure code reported on the inpatient claim to adjust for the primary surgery that was performed.

Statistical Analyses

To assess differences in characteristics between surgical cases with anesthesiologist assistant and nurse anesthetist involvement, we used a *t* test for continuous variables (*e.g.*, age) and a chi-square test for discrete variables (*e.g.*, comorbidities). However, because of our large sample, even trivially small differences may be statistically significant. Therefore, we used Hedges's g to estimate the magnitude of the standardized difference between the two groups of cases. Specifically, Hedges's g is the actual difference between the means of two groups divided by the population SD,[20] with values of less than 0.2 typically representing small differences between

Table 1. Sample Summary Statistics

	NA (n = 421,230)	AA (n = 21,868)	*P* Value	Hedges's g
Age, yr	75 (75–75)	75 (75–75)	< 0.001	0.05
Male, %	44.0 (43.8–44.1)	44.0 (43.3–44.6)	0.97	< 0.01
White, %	89.3 (89.2–89.4)	86.1 (85.6–86.5)	< 0.001	0.10
Congestive heart failure, %	10.6 (10.5–10.7)	11.0 (10.5–11.4)	0.10	0.01
Arrhythmia, %	16.8 (16.7–16.9)	16.4 (15.9–16.9)	0.14	0.01
Valvular disease, %	5.4 (5.4–5.5)	6.5 (6.2–6.8)	< 0.001	0.05
Pulmonary circulation disorders, %	1.5 (1.4–1.5)	1.6 (1.5–1.8)	0.06	0.01
Peripheral vascular disease, %	10.2 (10.1–10.3)	11.7 (11.3–12.2)	< 0.001	0.05
Hypertension, uncomplicated, %	55.4 (55.2–55.6)	55.6 (54.9–56.2)	0.70	< 0.01
Hypertension, complicated, %	8.3 (8.3–8.4)	9.8 (9.4–10.2)	< 0.001	0.05
Paralysis, %	0.6 (0.6–0.6)	0.7 (0.6–0.7)	0.17	0.01
Other neurologic disorders, %	4.0 (4.0–4.1)	3.8 (3.5–4.0)	0.07	0.01
Chronic pulmonary disease, %	17.8 (17.7–18.0)	17.6 (17.1–18.1)	0.39	0.01
Diabetes, uncomplicated, %	20.0 (19.8–20.1)	20.6 (20.0–21.1)	0.023	0.02
Diabetes, complicated, %	3.7 (3.6–3.7)	3.7 (3.3–3.9)	0.88	<0.01
Hypothyroidism, %	11.9 (11.9–12.0)	11.6 (11.1–12.0)	0.12	0.01
Renal failure, %	7.8 (7.7–7.9)	9.5 (9.1–9.9)	< 0.001	0.06
Liver disease, %	1.3 (1.3–1.3)	1.3 (1.1–1.5)	0.76	< 0.01
Peptic ulcer disease, without bleeding, %	0.6 (0.5–0.6)	0.5 (0.4–0.6)	0.06	0.01
AIDS/HIV, %	0.0	0.0	0.18	< 0.01
Lymphoma, %	0.8 (0.8–0.8)	0.9 (0.7–1.0)	0.23	< 0.01
Metastatic cancer, %	3.7 (3.6–3.8)	3.7 (3.4–3.9)	0.76	< 0.01
Solid tumor, without metastasis, %	11.9 (11.8–12.0)	11.5 (11.1–11.9)	0.07	0.01
Rheumatoid arthritis/collagen vascular disease, %	3.1 (3.0–3.1)	3.2 (2.9–3.4)	0.48	< 0.01
Coagulopathy, %	2.8 (2.7–2.8)	3.3 (3.0–3.5)	< 0.001	0.03
Obesity, %	6.0 (5.9–6.1)	6.4 (6.1–6.7)	0.014	0.02
Weight loss, %	3.4 (3.3–3.4)	4.3 (4.1–4.6)	< 0.001	0.05
Fluid and electrolyte disorders, %	14.0 (13.9–14.1)	15.3 (14.8–15.8)	< 0.001	0.04
Blood loss anemia, %	1.5 (1.4–1.5)	1.6 (1.4–1.7)	0.39	0.01
Deficiency anemia, %	1.2 (1.1–1.2)	1.4 (1.2–1.5)	0.011	0.02
Alcohol abuse, %	0.8 (0.8–0.9)	0.9 (0.7–1.0)	0.71	< 0.01
Drug abuse, %	0.8 (0.7–0.8)	0.6 (0.5–0.7)	0.008	0.02
Psychoses, %	0.6 (0.6–0.6)	0.5 (0.4–0.6)	0.29	0.01
Depression, %	6.3 (6.2–6.4)	5.8 (5.5–6.1)	0.005	0.02

The table presents summary statistics for our sample, separately for patients receiving care from a nurse anesthetist (NA) or an anesthesiologist assistant (AA). *P* refers to the statistical significance of differences between the two groups, assessed by *t* test for age and by chi-square test for the remaining variables. Hedges's g refers to significance in terms of magnitude between the two groups, with values less than 0.2 representing small differences, values from 0.2 to 0.5 representing moderate differences, and values more than 0.5 representing large differences. 95% CIs are shown in parentheses.

two groups, values of 0.2 to 0.5 representing moderate differences, and values larger than 0.5 representing large differences.[21]

A simple comparison of outcomes between care teams with nurse anesthetists *versus* anesthesiologist assistants is likely to be confounded. To address this issue, our analysis adjusted for a robust set of potential confounders, such as patient characteristics (age, race, and sex), year of surgery, patient medical history (the set of comorbidities comprising the Elixhauser index; shown in table 1), and the ICD-9 procedure code for the given admission.

However, confounding from unobserved differences between the cases assigned to care teams with anesthesiologist assistants and nurse anesthetists could persist despite adjusting for the observable factors described above. As a first step toward minimizing confounding, our analysis also included fixed effects for each hospital to control for time invariant observable and unobservable characteristics (*e.g.*, academic status, general case mix) specific to the hospital. In essence, by adding hospital fixed effects, our approach compares outcomes between care teams with anesthesiologist assistants and nurse anesthetists *within a given hospital* who are involved in similar types of surgeries for similar types of patients.

While comparing outcomes *within* a given hospital avoids confounding that could occur because of differences between hospitals that use care teams with anesthesiologist assistants and those that use nurse anesthetists, it does not address the issue of confounding between anesthesiologist assistant and nurse anesthetist cases *within* a given hospital (*e.g.*, the possibility of schedulers preferentially assigning lower-risk cases to care team with anesthesiologist assistants). Therefore, we employed an instrumental variable approach to further minimize confounding. The instrumental variable approach identifies the causal effect of a policy or treatment using an instrument, which is any variable that (1) influences the independent variable of interest (in this case, whether the patient received care from an anesthesiologist assistant) but (2) is otherwise independent of the outcomes of interest (after controlling for the remaining independent variables). In effect, the instrument is used to quasirandomize patients to anesthesiologist assistants. For this analysis, we used variation in the daily number of anesthesiologist assistants available to do cases on the given day of surgery. There is likely to be day-to-day fluctuation in the number of anesthesiologist assistants available to do cases for several reasons. First, anesthesiologist assistants take vacation or call in sick. Second, "full-time" work for many anesthesiologist assistants involves less than 5 days per week. Finally, laws permitting anesthesiologist assistant practice changed during the study period (Supplemental Digital Content, http://links.lww.com/ALN/B729, appendix table A.1). For example, North Carolina passed legislation enabling anesthesiologist assistant practice in 2007, and Oklahoma followed in 2008. All these factors drive day-to-day fluctuations in the number of anesthesiologist assistants available to do work, which directly impacts the probability that an anesthesiologist assistant will be part of the care team for a given case. For example, if a patient arrives for surgery on a day when an anesthesiologist assistant has called in sick, an anesthesiologist assistant is less likely to be assigned to their care team. Moreover, none of these factors driving anesthesiologist assistant availability is likely to be associated with unobservable surgical and patient characteristics that might impact outcomes, particularly because decisions about anesthesiologist assistant scheduling (*e.g.*, the setting of vacation schedules) and laws permitting anesthesiologist assistant practice are typically made well in advance of the date of surgery. Although we do not directly observe the number of anesthesiologist assistants available to do cases on the given day, we do observe a closely related proxy: the daily percentage of a given hospital's cases that involved anesthesiologist assistants. The daily percentage of cases involving anesthesiologist assistants should reflect the number of anesthesiologist assistants available to do cases, because if there are fewer anesthesiologist assistants available to do cases, the hospital must find other providers (*e.g.*, anesthesiologists or nurse anesthetists) to do the cases. A conceptually similar approach has been used to identify the effect of teacher quality on long-term outcomes.[22]

We implemented our instrumental variable approach using a multivariable two-stage least-squares regression. The regression model included the adjustments for potential confounders (*e.g.*, patient sex, medical history, hospital fixed effects) previously described and used the daily percentage of a given hospital's surgeries that were performed by care teams with anesthesiologist assistants as an instrument for whether the patient actually received care from a care team with an anesthesiologist assistant. Further details of our instrumental variable approach are provided in the technical appendix found in the Supplemental Digital Content (http://links.lww.com/ALN/B729). All statistical analyses were performed using STATA 14.0 (STATA Corporation, USA). Because our study reports a negative finding, we did not adjust our significance thresholds for multiple comparisons, because in the light of a negative finding, *not* adjusting for multiple comparisons is conservative.

Our study design and this manuscript were prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines. The study protocol was approved by the Stanford Institutional Review Board (Stanford, California), who also issued a waiver of consent.

Sensitivity Analyses

We examined the robustness of the baseline statistical approach described above to alternative models of risk adjustment. Relative to our baseline approach, each of these alternative models achieves greater precision and statistical power but is more vulnerable to confounding from unobservable differences between patients that are treated by care teams with nurse anesthetists compared to patients that are treated by care teams with anesthesiologist assistants. First, we considered a model in which we used hospital fixed effects to model differences in unobservable factors across hospitals but in which we did not implement our instrumental variable approach. Rather, in this model, the independent variable of interest was simply whether an anesthesiologist assistant or nurse anesthetist was part of the care team. Second, we estimated a model that used a random-effects approach instead of a fixed-effects approach to model differences across hospitals. Finally, although our baseline approach used the ICD-9 procedure code to model surgical complexity, we considered two alternative ways of modeling surgical complexity. First, we estimated models in which we adjusted for the diagnosis-related group instead of the ICD-9 procedure code. Second, we estimated models in which we modeled surgical complexity using a random effects approach based on the ICD-9 procedure code.

Study Funding

This project received funding from the American Society of Anesthesiologists (ASA; Schaumburg, Illinois). The details of the funding mechanism are described in the Research Support section, and crucially, Drs. Sun and Baker retained final control over study design, manuscript formulation, and publication decisions. As part of the peer-review process for this manuscript, the original request for proposals from the ASA, the authors' initial research proposal to the ASA, and the final submitted proposal and plan for analysis after comments from the ASA were provided to Anesthesiology and the reviewers. Of note, the initial request for proposals called for the examination of additional outcomes related to patient safety indicators developed by the Agency for Healthcare Research and Quality (Rockville, Maryland).[16] During the early stages of this study, the investigators realized that although the study was adequately powered to find differences in mortality, length of stay, and costs, many of these

patient safety indicators imposed additional exclusion criteria that would drastically reduce the sample size. As a result, we elected not to proceed further with analyses on these outcomes. In the interest of transparency, during the peer review process we performed these additional analyses, which can be found in the Supplemental Digital Content (http://links.lww.com/ALN/B729) as appendix table A.3. These results do not differ significantly from the results reported here.

Results

Our final sample consisted of 421,230 surgical cases in which the care team consisted of a physician anesthesiologist and a nurse anesthetist, and 21,868 cases in which the care team consisted of a physician anesthesiologist and an anesthesiologist assistant (table 1). Care teams with anesthesiologist assistants had younger patients (average age 75 yr, $P < 0.001$) who were less likely to be white (86.1 *vs.* 89.3%, $P < 0.001$). There was no significant sex difference between the two groups (44% male for both groups; $P = 0.97$). For 19 of the 31 comorbidities we examined, such as congestive heart failure and liver disease, there were no statistically significant differences. Of the remaining 12 comorbidities, 10 had a higher prevalence among cases with anesthesiologist assistant care teams (*e.g.*, coagulopathy, peripheral vascular disease), whereas 2 (drug abuse and depression) were less prevalent among this group. However, while statistically significant, the magnitude of differences between the two groups was fairly small for all of the characteristics we examined (Hedges' g less than 0.15 for all characteristics).

The unadjusted mortality for cases with anesthesiologist assistant care teams and for cases with nurse anesthetist teams was 1.7% (95% CI, 1.5 to 1.9, for anesthesiologist assistant teams and 95% CI, 1.6 to 1.7, for nurse anesthetist teams; $P = 0.87$ for the difference; fig. 1). After adjusting for observable and unobservable differences in case mix, patient characteristics, and hospital characteristics using the methods previously described, we found a slightly lower mortality for cases with anesthesiologist assistant care teams (1.6%; 95% CI, 1.4 to 1.8) compared to cases with nurse anesthetist care teams (1.7%; 95% CI, 1.7 to 1.7), although this difference was not statistically significant (0.08 percentage points; 95% CI, −0.3 to 0.1; $P = 0.47$). Although the unadjusted length of stay was higher for cases with anesthesiologist assistant care teams (6.7 *vs.* 6.4 days; $P = 0.06$), the risk-adjusted length of stay was approximately 6.4 days for both groups (95% CI, 6.4 to 6.4, for nurse anesthetists *vs.* 95% CI, 6.3 to 6.5, for anesthesiologist assistants; fig. 2), and the difference was not statistically significant (−0.009 days; 95% CI, −0.1 to 0.1; $P = 0.89$). Unadjusted medical spending was higher for care teams with an anesthesiologist assistant ($23,630 *vs.* $21,803; $P < 0.001$), but adjusted medical spending was lower ($21,841 *vs.* $21,897; fig. 3), and the implied $56 reduction in spending was not statistically significant (95% CI, −334 to 223; $P = 0.70$). Our findings were robust to several alternative statistical models, such as the model where we used random effects to adjust for differences across hospitals (table 2).

Discussion

In the United States, anesthesia care is often provided in the setting of an anesthesia care team consisting of nonphysician providers (anesthesiologist assistants and nurse anesthetists) who work under the supervision of a physician anesthesiologist. Although nurse anesthetists can practice nationwide,

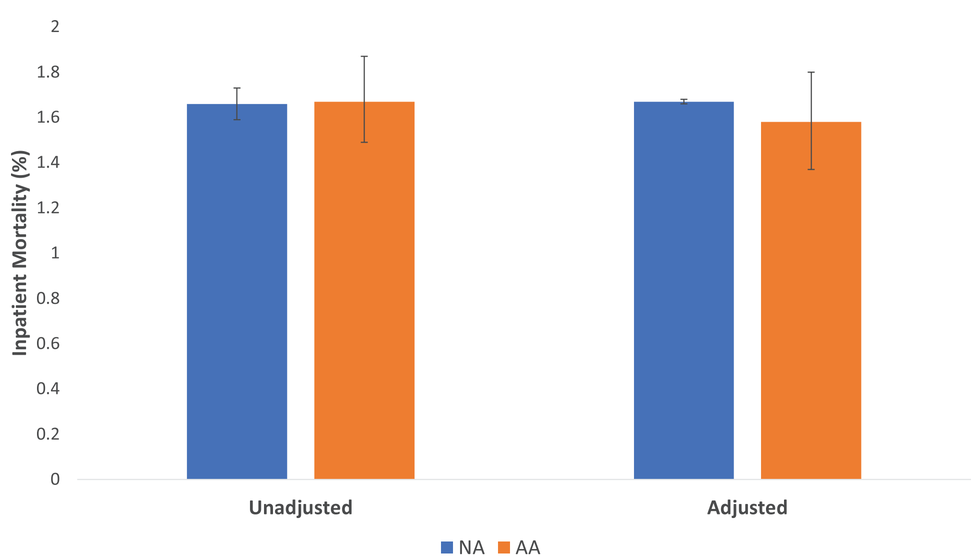

Fig. 1. Unadjusted and adjusted inpatient mortality, stratified by the composition of the anesthesia care team. The figure presents unadjusted and adjusted inpatient mortality rates separately for patients receiving care from anesthesia care team with nurse anesthetists (NA; *blue*) and care teams with anesthesiologist assistants (AA; *orange*). "Adjusted" refers to analyses that adjust for differences in surgery types, the patient characteristics listed in table 1, and hospital characteristics, using the approach described under Materials and Methods. The *error bars* represent 95% CIs and were calculated using standard errors that were clustered at the hospital level.

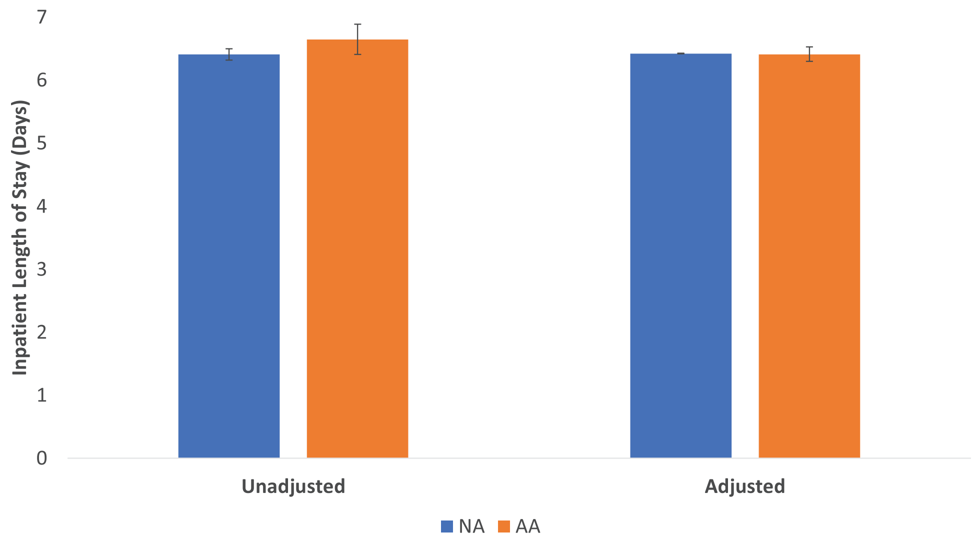

Fig. 2. Unadjusted and adjusted inpatient length of stay, stratified by composition of the anesthesia care team. The figure presents unadjusted and adjusted inpatient length of stay, separately for patients receiving care from anesthesia care team with nurse anesthetists (NA; *blue*) and care teams with anesthesiologist assistants (AA; *orange*). "Adjusted" refers to analyses that adjust for differences in surgery types, the patient characteristics listed in table 1, and hospital characteristics, using the approach described under Materials and Methods. The *error bars* represent 95% CIs and were calculated using standard errors that were clustered at the hospital level.

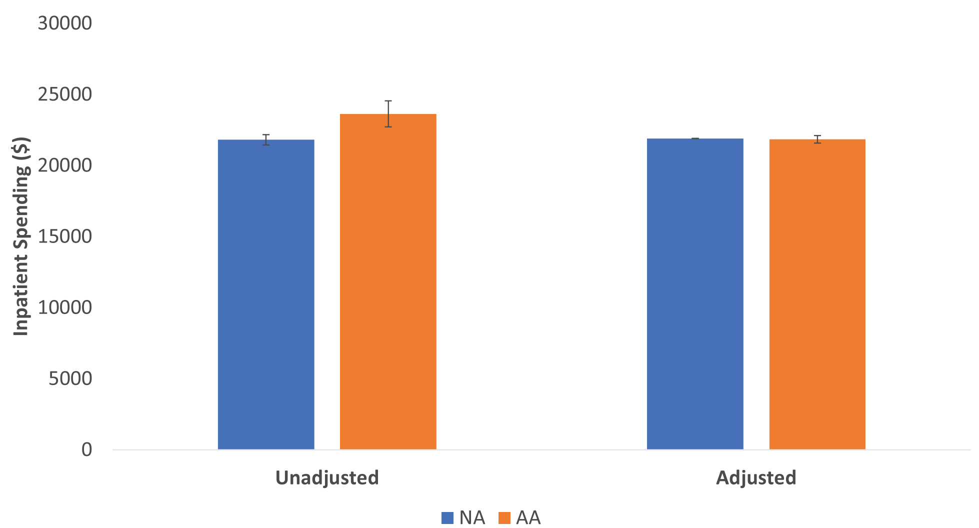

Fig. 3. Unadjusted and adjusted inpatient spending, stratified by the composition of the anesthesia care team. The figure presents unadjusted and adjusted inpatient spending, separately for patients receiving care from anesthesia care team with nurse anesthetists (NA; *blue*) and care teams with anesthesiologist assistants (AA; *orange*). "Adjusted" refers to analyses that adjust for differences in surgery types, the patient characteristics listed in table 1, and hospital characteristics, using the approach described under Materials and Methods. The *error bars* represent 95% CIs and were calculated using standard errors that were clustered at the hospital level.

anesthesiologist assistants can only practice in 16 states and the District of Columbia, and efforts to expand the areas where anesthesiologist assistants can practice have been challenged by concerns over poorer patient outcomes. However, whether these concerns have an empirical basis has not been studied. To inform policymaking regarding the scope of anesthesiologist assistant practice, we compared outcomes between care teams with nurse anesthetists to care teams with anesthesiologist assistants for elderly patients undergoing inpatient surgery. Our study found no statistically significant difference in outcomes of mortality, length of stay, and spending between these two types of care teams. In addition, the narrow CIs around our estimated results suggest that our null findings are due to a true lack of association, as opposed to imprecision in our estimates.

The key implication of our findings is that the specific composition of the anesthesia care team—in other words, whether the physician anesthesiologist supervises a nurse

Table 2. Association between Use of Anesthesiologist Assistants and Perioperative Outcomes, Alternative Model Specifications

	Outcome			
Model	Death, %	Length of Stay, days	Inpatient Spending, $	Notes
Baseline analysis	−0.08 (95% CI, −0.3 to 0.1) P = 0.47	−0.009 (95% CI, −0.1 to 0.1) P = 0.89	−56 (95% CI, −334 to 223) P = 0.70	Baseline model
Fixed effects only	−0.01 (95% CI, −0.2 to 0.2) P = 0.91	−0.01 (95% CI, −0.1 to 0.08) P = 0.78	−68 (95% CI, −292 to 156) P = 0.55	This model omitted the instrumental variables approach used for the baseline analyses but retained the hospital fixed effects to adjust for differences across hospitals
Random-effects model (hospital)	−0.2 (95% CI, −0.3 to 0.02) P = 0.09	−0.02 (95% CI, −0.1 to 0.07) P = 0.63	−41 (95% CI, −262 to 180) P = 0.72	This model adjusted for differences across hospital using a random-effects approach instead of a fixed-effects approach
Random-effects model (procedure)	0.03 (95% CI, −0.2 to 0.2) P = 0.76	−0.002 (95% CI, −0.1 to 0.09) P = 0.97	48 (95% CI, −182 to 280) P = 0.68	This model adjusted for surgical complexity using a random-effects approach instead of a fixed-effects approach
DRG adjustment	−0.04 (95% CI, −0.3 to 0.2) P = 0.74	0.05 (95% CI, −0.07 to 0.2) P = 0.44	237 (95% CI, −62 to 535) P = 0.12	This model adjusted for surgical complexity using the DRG instead of the surgical procedure code

The table presents the results of sensitivity analyses in which we considered the robustness of our results to alternative statistical model. Baseline Analysis refers to the baseline model used to produce the main results discussed in the text. The alternative statistical models were a fixed-effects only model, a model with random effects for hospitals, a model with random effects for procedure, and a model that used diagnosis-related groups (DRG) to adjust for surgical complexity. A brief description of each model is provided under Notes. The table presents the estimated association between anesthesiologist assistant care and the given outcome. For death, the table shows the estimated percentage point change in inpatient mortality. The 95% CI values shown in parentheses were calculated using robust standard errors.

anesthetist or an anesthesiologist assistant—is not likely to be associated with differences in patient outcomes. In some respects, this is not a surprising finding, because particularly at academic centers, physicians successfully supervise trainees and nonphysician providers with a wide variety of backgrounds and experience. As a particularly striking example, consider that at academic medical centers, the most experienced trainees complete training and leave on July 1, to be replaced by a new set of unexperienced medical trainees. However, a large portion of the literature suggests that this turnover (the "July effect") is not associated with any difference in patient outcomes,[23] suggesting that potentially problematic effects of rather drastic differences in experience among medical trainees can be mitigated with appropriate systems, teams, and physician supervision. In this context, we emphasize that our results do not address whether, in isolation, anesthesiologist assistants or nurse anesthetists are systemically "better" for patients. Instead, our results suggest that the team structures and physician supervision in place in this study context are able to mitigate any systemic differences between the two groups, if they exist at all.

Our study should be viewed in light of its limitations. First, as with all retrospective analyses, we cannot exclude the possibility of residual confounding. In particular, our data did not allow us to adjust for provider experience or differences in supervision ratios between anesthesiologist assistants and nurse anesthetists or differences in case assignment based on unobservable measures of patient complexity. However, we made extensive efforts to minimize the possibility of confounding. Because we compared outcomes *within* a given hospital, our results would only be confounded to the extent that *within* a given hospital, patients taken care of by anesthesiologist assistant care teams are at lower risk than those taken care of by nurse anesthetist care teams. Moreover, we found no significant differences between patients who received care from an anesthesiologist assistant care team compared to those who received care from a nurse anesthetist care team for most of the characteristics we considered (*e.g.*, patient comorbidities; see table 1), and where there were differences, they suggested that anesthesiologist assistant care teams tended to take care of *higher*-risk patients. Finally, our analysis adjusted for an extensive set of potential confounders and utilized a quasirandomization approach to further minimize confounding.

Second, our analysis was limited to elderly Medicare patients undergoing inpatient surgery, a high-risk population. Third, our study covered the time period between 2004 and 2011. Although the vast majority of the 17 jurisdictions (16 states and the District of Columbia) that enabled anesthesiologist assistant practice did so either before or during the study period, one state (Indiana) enabled anesthesiologist assistant practice in 2014, outside of our study period. Fourth, because our study could not measure supervision ratios, we cannot draw any conclusions about the optimal supervision ratio for either anesthesiologist assistants or nurse anesthetists. Fifth, our study was not designed to address the question of whether there are benefits from independent anesthesiologist assistant practice. Sixth, our study did not measure other potential quality measures (*e.g.*, mortality 30 days postdischarge, incidence of intensive care unit admission). Seventh, it should be noted that although all the nurse anesthetists and anesthesiologist assistants in our analysis were supervised by a physician, nurse anesthetists can (in rare cases) be supervised by the surgeon or proceduralist as opposed to a physician anesthesiologist, and we were unable to exclude cases where this could have occurred. Finally, with regards to medical spending, our study did not address whether the expanded use of anesthesiologist assistants could change the structure of the anesthesia workforce and alter the nature of competition between anesthesia providers. How these potential changes would affect the negotiated prices paid by private insurers to anesthesia providers is a subject for future study.

In conclusion, among elderly patients undergoing inpatient surgery, our study found no significant differences in outcomes between care teams with anesthesiologist assistants compared to care teams with nurse anesthetists. Further work should examine whether these results extend to other patient populations and types of surgery, including, for instance, privately insured patients and outpatient surgeries. Moreover, because improving access to care is a frequently cited rationale for expanding the use of midlevel anesthesia providers,[24–26] further research should examine whether the introduction of anesthesiologist assistants has improved access to care. Finally, from a regulatory and antitrust standpoint, understanding the extent to which the introduction of anesthesiologist assistants has impacted competition among groups of anesthesia providers is a fruitful area for further research.

Research Support

Supported by funding from the American Society of Anesthesiologists (ASA, Schaumburg, Illinois; to Dr. Sun, Dr. Baker, and Ms. Moshfegh). The ASA issued a request for proposals to three organizations, including Stanford, for a study to compare outcomes between anesthesia care teams with anesthesiologist assistants and anesthesia care teams with nurse anesthetists. Drs. Sun and Baker elected to respond to the request and prepared a bid including an outline of the study methodology, which they developed without input from the ASA. In all, the ASA received three bids. The decision on which bid to accept was made by the Executive Committee of the ASA, with Dr. Miller's input. Dr. Miller is employed by the ASA.

Competing Interests

Dr. Miller is employed by the American Society of Anesthesiologists. Although all authors participated in the study design, data analysis, manuscript preparation, and publication decisions, the funding arrangement provided that the Stanford investigators—specifically Drs. Sun and Baker—had the final say over all elements of the study.

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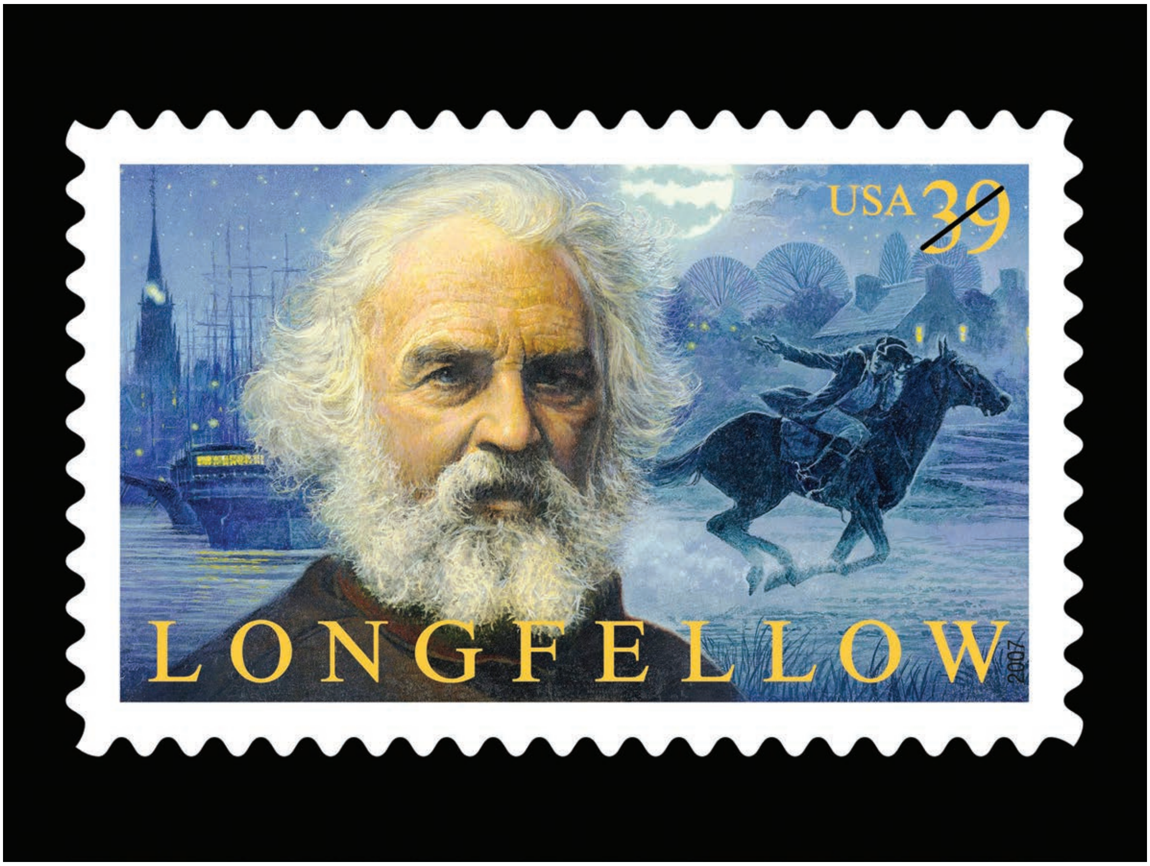
References

1. Grumbach K, Bodenheimer T: Can health care teams improve primary care practice? JAMA 2004; 291:1246–51
2. Hogan PF, Seifert RF, Moore CS, Simonson BE: Cost effectiveness analysis of anesthesia providers. Nurs Econ 2010; 28:159–69
3. Hooker RS, Muchow AN: Modifying state laws for nurse practitioners and physician assistants can reduce cost of medical services. Nurs Econ 2015; 33:88–94
4. Naylor MD, Kurtzman ET: The role of nurse practitioners in reinventing primary care. Health Aff (Millwood) 2010; 29:893–9
5. Frakes MA, Evans T: An overview of Medicare reimbursement regulations for advanced practice nurses. Nurs Econ 2006; 24:59–65
6. Daugherty L, Benito RF, Kumar KB, Michaud P-C: Is There a Shortage of Anesthesia Providers in the United States? Santa Monica, California, Rand Corporation, 2010
7. Dall T, Chakrabarti R, Iacobucci W, Hansari A, Terry: The Complexities of Physician Supply and Demand: Projections from 2015 to 2030. Washington, D.C., American Association of Medical Colleges, 2017
8. Fallacaro MD, Ruiz-Law T: Distribution of US anesthesia providers and services. AANA J 2004; 72:9–14
9. Baird M, Daugherty L, Kumar KB, Arifkhanova A: The Anesthesiologist Workforce in 2013. Santa Monica, California, Rand Corporation, 2013
10. Venning P, Durie A, Roland M, Roberts C, Leese B: Randomised controlled trial comparing cost effectiveness of general practitioners and nurse practitioners in primary care. BMJ 2000; 320:1048–53
11. Miller TR, Abouleish A, Halzack NM: Anesthesiologists are affiliated with many hospitals only reporting anesthesia claims using modifier QZ for Medicare claims in 2013. A A Case Rep 2016; 6:217–9
12. Amburgey B, Fordham M, Payne B, Trebelhorn M: A Study of Anesthesiologist Assistants. Research Report No. 337. Frankfort, Kentucky, Legislative Research Commission, 2007. Available at: http://www.lrc.ky.gov/lrcpubs/RR337.pdf. Accessed May 15, 2017
13. An Overview of Medicare. Menlo Park, California, Kaiser Family Foundation, 2017. Available at: http://kff.org/medicare/issue-brief/an-overview-of-medicare/. Accessed May 15, 2017
14. Medicare Advantage Enrollees as a Percent of Total Medicare Population. Kaiser Family Foundation State Health Facts. Available at: http://kff.org/medicare/state-indicator/enrollees-as-a-of-total-medicare-population/. Accessed May 15, 2017
15. Springer JE, Bailey JG, Davis PJ, Johnson PM: Management and outcomes of small bowel obstruction in older adult patients: A prospective cohort study. Can J Surg 2014; 57:379–84
16. Patient Safety Indicators Overview. Agency for Healthcare Research and Quality Patient Safety Indicators Resources, 2018. Available at: https://www.qualityindicators.ahrq.gov/modules/psi_overview.aspx. Accessed April 14, 2018
17. Cohen AS, Patek R, Enkemann SA, Johnson JO, Chen T, Toloza E, Vagner J, Morse DL: δ-Opioid receptor (δOR) targeted near-infrared fluorescent agent for imaging of lung cancer: Synthesis and evaluation *in vitro* and *in vivo*. Bioconjug Chem 2016; 27:427–38
18. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, Saunders LD, Beck CA, Feasby TE, Ghali WA: Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Med Care 2005; 43:1130–9

19. Quan H, Li B, Couris CM, Fushimi K, Graham P, Hider P, Januel JM, Sundararajan V: Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. Am J Epidemiol 2011; 173:676–82
20. Hedges LV: Distribution theory for Glass's estimator of effect size and related estimators. J Educ Behav Stat 1981; 6: 107–28
21. Sawilowsky SS: New effect size rules of thumb. J Mod Appl Stat Methods 2009; 8:597–9
22. Chetty R, Friedman JN, Rockoff JE: Measuring the impacts of Teachers II: Teacher value-added and student outcomes in adulthood. Am Econ Rev 2014; 104: 2633–79
23. Young JQ, Ranji SR, Wachter RM, Lee CM, Niehaus B, Auerbach AD: "July effect": Impact of the academic year-end changeover on patient outcomes: A systematic review. Ann Intern Med 2011; 155:309–15
24. Sun E, Dexter F, Miller TR: The effect of "opt-out" regulation on access to surgical care for urgent cases in the United States: Evidence from the national inpatient sample. Anesth Analg 2016; 122:1983–91
25. Sun EC, Miller TR, Halzack NM: In the United States, "opt-out" states show no increase in access to anesthesia services for Medicare beneficiaries compared with non-"opt-out" states. A A Case Rep 2016; 6:283–5
26. Sun EC, Dexter F, Miller TR, Baker LC: "Opt out" and access to anesthesia care for elective and urgent surgeries among U.S. Medicare beneficiaries. ANESTHESIOLOGY 2017; 126:461–71

ANESTHESIOLOGY REFLECTIONS FROM THE WOOD LIBRARY-MUSEUM

How Two Longfellows Revered Ether



Issued in 2007 with images of Boston's Old North Church and the midnight rider Paul Revere, this 39-cent U.S. postal stamp commemorated the 200th anniversary of the birth of American poet Henry Wadsworth Longfellow (1807 to 1882). Because Georgia's Crawford Long, M.D., failed to publish his use of obstetric ether more than 2 yr earlier, Longfellow's wife Fanny became the first American *recorded* to have received ether for obstetric anesthesia. (Note: Fanny's etherization by Dr. Nathan Cooley Keep occurred more than 3 months after Professor James Y. Simpson's use in Scotland of obstetric ether.) Severely burned in 1861 after her dress had caught fire, Mrs. Longfellow was given ether for analgesia before she succumbed to her injuries. While using a rug and his own body to extinguish the flames, Henry had been burned severely enough to miss Fanny's funeral and to warrant growing a beard to hide his scars. As a widower, Longfellow assuaged both his burning pain and his unrelenting grief with ether. (Copyright © the American Society of Anesthesiologists' Wood Library-Museum of Anesthesiology.)

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Statement Comparing Anesthesiologist Assistant and Nurse Anesthetist Education and Practice

Committee of Origin: Anesthesia Care Team

(Approved by the ASA House of Delegates on October 17, 2007, and last amended on October 25, 2017)

Anesthesiologist assistants and nurse anesthetists both are non-physician members of the anesthesia care team (ACT). Their role in patient care is described in the American Society of Anesthesiologists (ASA) "Statement on the Anesthesia Care Team." The ASA document entitled "Recommended Scope of Practice of Nurse Anesthetists and Anesthesiologist Assistants" further delineates the recommended and safe limits of clinical practice. These documents summarize ASA's view that anesthesiologist assistants and nurse anesthetists share identical patient care responsibilities, a comparable knowledge base, and comparable technical skills, a view in harmony with their equivalent treatment by the Centers for Medicare and Medicaid Services (CMS). The proven safety of the team approach to anesthesia when physician anesthesiologists work with anesthesiologist assistants and/or nurse anesthetists confirms the enduring wisdom of this view.

Nonetheless, differences exist between anesthesiologist assistants and nurse anesthetists with regard to educational program prerequisites, instruction, and requirements for supervised clinical practice. The purpose of this document is to review these for purposes of comparison, to summarize changes that have taken place in the respective curricula, and to assess their current and potential future significance.

1. Historical Background of Anesthesiologist Assistants and Nurse Anesthetists

    a. Nurse Anesthetists

The discipline of nurse anesthesia developed in the late 1800s and early 1900s. Few physicians focused their attention on anesthesia at that time, so anesthesia typically was given by nurses under surgeon direction. There was a recognized need for the development of formal education and training. The first formal nurse anesthesia program was founded at St. Vincent's Hospital in Portland, Oregon, in 1909. The first certification examinations were administered in 1945. A nursing diploma was sufficient for entry into nurse anesthesia programs until 1986, when the prerequisite was established for a bachelor's degree in nursing or a related field. By 1998, all programs were required to provide a graduate level of education, awarding a "Master of Science in Nurse Anesthesia" or MSNA degree. At that time, nurse anesthetists who had graduated from non-master's degree programs were "grandfathered" into the new system, and allowed to continue practicing without further graduate education. Once an accredited nurse anesthesia educational program has been completed, the graduate nurse anesthetist must pass a certification examination administered by the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA).

In 2007, the American Association of Nurse Anesthetists (AANA) adopted a position statement supporting further graduate education, and recommending that the entry to practice degree for nurse anesthetists be moved to the "doctoral" level by 2025. The degree to be awarded is the "practice doctorate", usually termed the "Doctor of Nursing Practice" degree (DNP) or the "Doctor of Nurse Anesthesia Practice" degree (DNAP). These "practice" or "clinical" degrees differ in rigor and requirements from the more demanding research doctorate (PhD) or the education doctorate (EdD), which are typically required for nurses who wish to ascend in academic rank. A nurse anesthetist with a master's degree may complete a DNP degree with as few as 32 credit hours of online coursework and no additional in-person educational requirement.

The Council on Accreditation of Nurse Anesthesia Educational Programs (COA) has stated that it will not accept any new master's degree programs for accreditation beyond 2015, and that students accepted into an accredited program after January 1, 2022, must graduate with the DNP or DNAP degree. As of July, 2016, more than 40 of the 115 nurse anesthesia programs have finalized the transition to offering a full BSN to DNP/DNAP program, and others are completing accreditation. These programs typically have extended their educational time requirement by six to 12 months, to a total of three years of full-time study or the part-time equivalent. Currently, 14 nurse anesthesia programs offer "completion" training, enabling nurse anesthetists with master's degrees to finish DNP/DNAP requirements. The curricula are described in more detail later in this document.

It appears clear that a chief objective in establishing the "practice" doctoral programs is to bolster the argument that nurse anesthetists should have the right to practice independent of any supervision, medical direction, or other involvement with a physician anesthesiologist or any other type of physician or dentist. Current controversies related to the question of whether nurse anesthetists should have the legal right to practice independently are the result of their history, tradition, philosophy of education, and political activism.

b. Anesthesiologist Assistants

The anesthesiologist assistant profession was established in the 1960s by three chairmen of academic anesthesiology departments: Joachim Gravenstein, MD, John Steinhaus, MD, PhD, and Perry Volpitto, MD. Concerned with the shortage of anesthesiologists in the US, they analyzed the tasks and skills required during anesthesia care and studied the educational pathway for physician anesthesiologists and nurse anesthetists. The result of this anesthesia workforce analysis was to introduce the formal concept of the anesthesia care team, and to define a new type of anesthesia practitioner whose work would always be linked with a supervising anesthesiologist. The three founders of the anesthesiologist assistant profession created a new educational paradigm for a master's degree anesthesia practitioner, emphasizing a premedical college background in science rather than in nursing. Their vision came to fruition in 1969, when the first training programs for anesthesiologist assistants began to accept students at Emory University in Atlanta, Georgia, and at Case Western Reserve University in Cleveland, Ohio.

Today, anesthesiologist assistant training programs are 24 to 28 months in duration, and the degree awarded is a Master of Science in Anesthesia or a Master of Medical Science. There are currently 11 anesthesiologist assistant educational programs accredited by the Commission for

Accreditation of Allied Health Education Programs (CAAHEP), all of which are associated with the anesthesiology department of a medical school and are directed by a board-certified physician anesthesiologist. The anesthesiology department must have the educational resources to qualify it to meet the criteria of the Accreditation Council for Graduate Medical Education (ACGME) for sponsorship of an anesthesiology residency program. Graduates or senior students in their last semester must pass a certifying examination administered by the National Commission for Certification of Anesthesiologist Assistants (NCCAA) in collaboration with the National Board of Medical Examiners (NBME).

Once fully trained, the anesthesiologist assistant fills the same clinical role as a nurse anesthetist, but shares a common practice philosophy with physician anesthesiologists and works exclusively with them. Anesthesiologist assistant education was designed to incorporate the basic principles supportive of the ACT. The founders recognized the advantages of a strong premedical background, and anticipated that some anesthesiologist assistants would choose to go on to medical school and careers as physician anesthesiologists. Thus by history, tradition, philosophy of education and personal preference, the anesthesiologist assistant is trained to work within the ACT under the supervision of a physician anesthesiologist.

2. Prerequisites for Entry

Nurse anesthetist schools admit baccalaureate-prepared students who have taken the science curriculum for general practice nursing, have current registration as a professional nurse, and have a minimum of one year of acute care experience. Some schools specify that the acute care experience must be in intensive care unit nursing; others permit emergency department experience to qualify. Some programs will not consider applicants with less than a 3.0 grade point average (GPA). Some programs require the Graduate Record Examinations (GRE) test for all applicants; some will waive it if the GPA is above a certain level, and some do not require the GRE for any applicant.

Anesthesiologist assistant programs require a bachelor's degree emphasizing premedical, science-based coursework and laboratory experience, including biology, general chemistry, organic chemistry, physics, and advanced college mathematics, with a GPA greater than 3.0. The required coursework is the same as that generally required by American medical schools. Prior health care experience is preferred though not required. Applicants must take either the Medical College Admissions Test (MCAT) or the GRE test.

There are two substantive differences between prerequisites for anesthesiologist assistant and nurse anesthetist education. Anesthesiologist assistants are not required to have clinical patient-care experience before they enter training. Nurse anesthetists are not required to have as comprehensive a background in basic science at the undergraduate level as the foundation for their clinical education. There is no objective evidence that either of these facts results in a detectable difference by the completion of training. The experience reported by physician anesthesiologists who work simultaneously with anesthesiologist assistants and nurse anesthetists is that there are no significant differences in skills, training, knowledge base, or clinical expertise.

3. Curriculum

For student nurse anesthetists matriculating on or after January 1, 2015, the minimum number of anesthesia cases required is 600, and the minimum number of clinical hours is 2000. These requirements have not changed for the programs that now offer the DNP/DNAP degree, nor is there any new didactic educational component. Experience with a minimum of 10 cases each is required for spinal and epidural anesthesia. The requirement for experience with peripheral nerve blocks may be satisfied in part by "simple models and simulated experiences"; the requirement for experience with placement of central venous catheters may be satisfied entirely with models and simulation.

The only respect in which the practice doctoral program differs from the traditional master's program in nurse anesthesia is in the requirement for a "substantial final written work product." Per the "Standards for Accreditation of Nurse Anesthesia Programs – Practice Doctorate", revised in June, 2016, this work product "may be in the form of a manuscript submitted for publication, a poster presented at a national meeting, design of innovative clinical practice model, or other effective means of dissemination. The structure and process of the scholarly work will vary according to the requirements of the governing institution and conform to accepted educational standards at the practice doctoral level."

For student anesthesiologist assistants, the minimum number of anesthesia cases required is 600, and the minimum number of clinical hours is 2000, the same as for nurse anesthetists. The requirement for regional anesthesia (unspecified) is the management and administration of 40 cases. There is a requirement for insertion of five central venous catheters, which cannot be satisfied by models or simulation. No change is anticipated in the fundamentals of anesthesiologist assistant education in the next five years, and there are no plans in process to consider implementing a doctoral program.

Anecdotally, training programs for anesthesiologist assistants and for nurse anesthetists vary in how much teaching and clinical practice students receive in regional anesthesia and in the placement of invasive monitoring lines. The decision to limit the teaching is based on the reservations expressed by many physician anesthesiologists about the safety of these techniques when performed either by anesthesiologist assistants or nurse anesthetists. The limitation on teaching is voluntary, consistent with ASA policy and with a view to patient safety. There is no evidence to suggest that the clinical abilities or technical skills of students in either profession limit their suitability for this aspect of practice. The ASA "Statement on Regional Anesthesia" allows for the supervising physician anesthesiologist to delegate, when appropriate, certain technical aspects of regional anesthesia procedures to a non-physician anesthetist.

It is noteworthy that the AANA-defined scope of nurse anesthesia practice includes services in acute, chronic, and interventional pain management, and the use of ultrasound, fluoroscopy, and other diagnostic technologies. However, there are no curriculum requirements currently in place to educate student nurse anesthetists in these modalities. In November, 2015, the AANA announced a partnership with Hamline University School of Education to offer an "Advanced Pain Management Certificate" for nurse anesthetists who have already completed the master's degree. This program requires four semesters (19 academic credits) of online study, and a supervised clinical component of 240 hours.

4. Physician Involvement in Anesthesia Care Delivery

The principle of physician supervision, present since the beginning of nurse anesthesia, has been maintained to this day, primarily through federal regulation, state statute, and hospital medical staff rules. The majority of anesthetics in the US are delivered within the care team model, where a physician anesthesiologist works with anesthesiologist assistants, residents, and/or nurse anesthetists. Anesthesiologist assistants invariably work under the medical direction of physician anesthesiologists, analogous to the way in which physician assistants work with physicians in other specialties.

In the majority of states, nurse anesthetists function in an ACT model with a physician anesthesiologist or under the supervision of the operating surgeon, dentist, or other non-anesthesiologist physician, thereby satisfying CMS requirements for physician supervision of nurse anesthesia. In limited circumstances, nurse anesthetists are authorized to practice without the involvement of a physician as a result of state law. State governors may also decide unilaterally to opt out of the CMS patient safety requirement for physician supervision of nurse anesthetists, though hospital rules, employment agreements, or other state regulations may retain the requirement for physician supervision. Individual state opt-out decisions appear to be motivated chiefly by political – not patient safety – reasons.

CMS has structured its payment system for physician anesthesiologist services into four categories: personally performed, teaching, medical direction, and medical supervision. These are indicated by different Medicare billing modifiers, and most commercial payers utilize the same payment system. CMS uses the term "qualified nonphysician anesthetists" to refer to nurse anesthetists and anesthesiologist assistants as a combined group, since in most billing circumstances the rules of payment for their services are the same. One exception is that the "QZ" modifier is specific to nurse anesthetists and does not apply to cases involving care by an anesthesiologist assistant. The "QZ" modifier is defined as nurse anesthetist service "without medical direction by a physician."

The use of the "QZ" modifier in billing does not necessarily mean that a nurse anesthetist was practicing solo without any involvement in the case by a physician anesthesiologist. A 2016 study showed that among 538 hospitals that filed all of their anesthesia claims using the modifier "QZ" in 2013, 48 percent had affiliated physician anesthesiologists. The authors concluded, "It seems likely that the physician anesthesiologists were involved in patient care and had some relationship with nurse anesthetists practicing at the hospitals."[4] Thus, use of the "QZ" modifier in billing for a case does not imply or prove that a physician anesthesiologist was never involved with the management of the anesthesia care. Outcomes data from cases billed using the "QZ" modifier cannot be used accurately as a surrogate for independent nurse anesthesia practice. The results of this study underscore the continuing influence and widespread acceptance of the anesthesia care team concept as critical to patient safety.

5. Maintenance of Certification

Once certified, every anesthesiologist assistant must be continually involved in the recertification process. Each anesthesiologist assistant must submit documentation of at least 40 hours of continuing medical education (CME) credit to the NCCAA every two years. Every six years, each anesthesiologist assistant must pass an examination for continued demonstration of qualifications (CDQ). The examination is administered by the NBME and addresses 16 core competencies.

Prior to August 1, 2016, there was no recertification examination for nurse anesthetists, though continuing education (CE) was required. As of August 1, 2016, the NBCRNA has instituted a new Continued Professional Certification (CPC) program for recertification of nurse anesthetists, comprised of two four-year cycles. The program requires accumulation of credits which may be earned through formal CE and through documentation of a range of professional activities. It also requires completion of “core modules” of educational content. At the end of the second four-year cycle, or every eight years, the nurse anesthetist must take a formal CPC Examination in four “core domains” of nurse anesthesia practice. The first “Performance Standard Exam” will be given between 2020 and 2024, and there will be no negative impact on certification regardless of score. The second “Passing Standard Exam” will be given between 2028 and 2033.

6. Conclusion

The Committee on the ACT studied and compared the prerequisites for program admission, the didactic curricula, and the clinical components of anesthesiologist assistant and nurse anesthetist educational programs with regard to scope of practice and overall quality. Reference was made to published program prerequisites, curricula, graduation requirements, the laws and regulations governing clinical practice, requirements for maintenance of certification, and available information on the safety of anesthesiologist assistant and nurse anesthetist practice.

The Committee concludes that differences do exist between anesthesiologist assistants and nurse anesthetists with regard to the educational program prerequisites, instruction, and requirements for supervision in practice as well as maintenance of certification. These are the result of the different routes that the two professions took toward development, and the stated preference of anesthesiologist assistants to work exclusively on teams with physician anesthesiologists. None of these differences, in the opinion of the Committee, results in significant disparity in knowledge base, technical skills, or quality of care.

References:

1. Council on Accreditation of Nurse Anesthesia Educational Programs. Standards for accreditation of nurse anesthesia educational programs. Approved 2004, revised June, 2016.
2. Council on Accreditation of Nurse Anesthesia Educational Programs. Standards for accreditation of nurse anesthesia educational programs – Practice Doctorate. Approved 2015, revised June, 2016.

3. Commission on Accreditation of Allied Health Education Programs. Standards and guidelines for the accreditation of educational programs for the anesthesiologist assistant. Approved 1987, revised 2009.
4. Miller T, Abouleish A, Halzack N. Anesthesiologists are affiliated with many hospitals only reporting anesthesia claims using modifier QZ for Medicare claims in 2013. A&A Case Reports: April 1, 2016, Vol 6 No 7, 217-219.