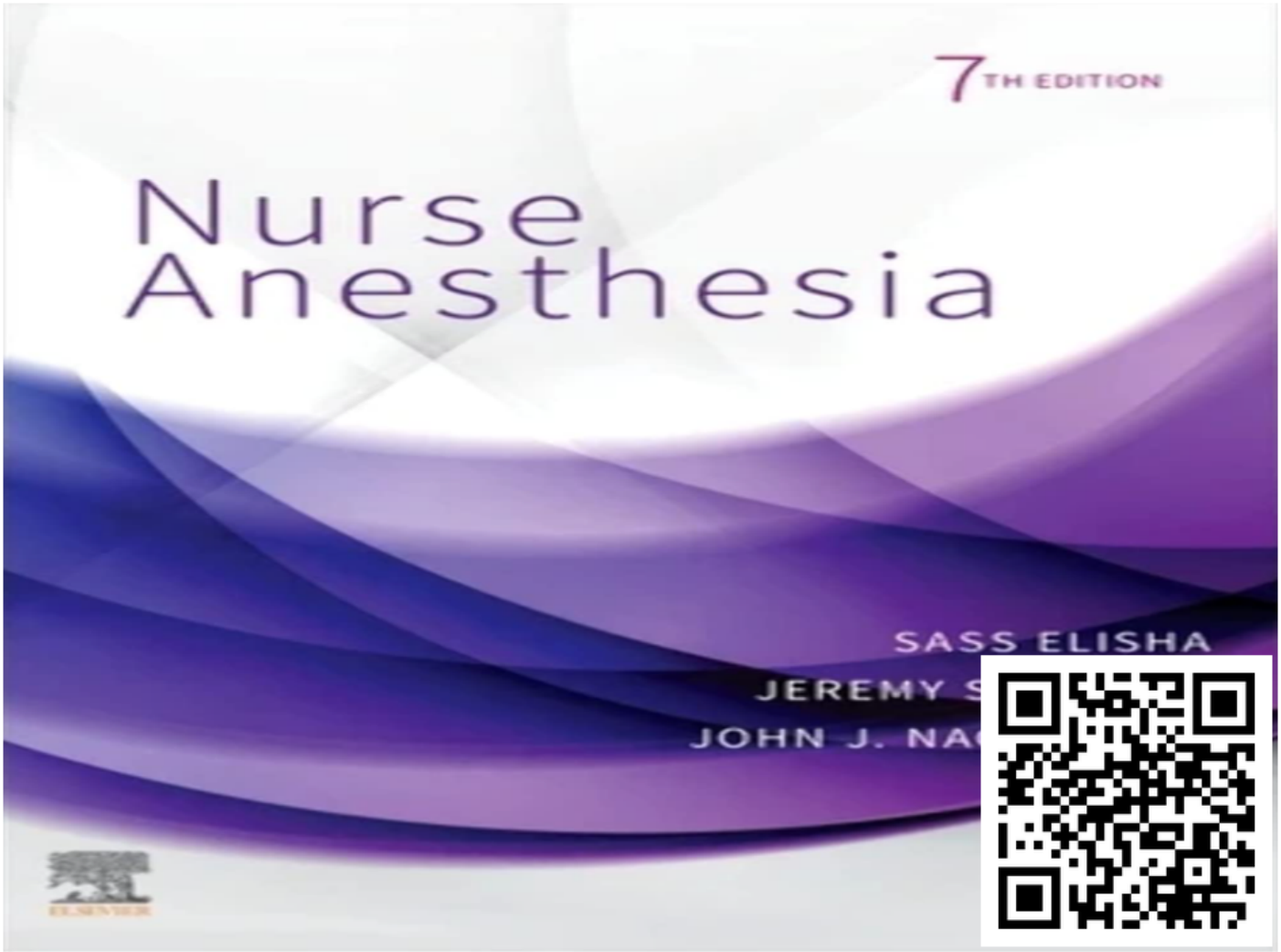

7TH EDITION

Nurse Anesthesia

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FOREWORD

We are reprinting the foreword written by John F. Garde from the first edition of *Nurse Anesthesia*, which was published in 1997. John encouraged the publication of the first edition of this text, two decades ago, as an important milestone in the evolution of the specialty of nurse anesthesia. He felt it showcased the breadth and depth of nurse anesthetists' contributions to research and clinical care. John conveyed his enthusiasm for the unique role of nurse anesthetists to everyone he encountered. He believed that anesthesia excellence was manifest when a clinician made a difference in the everyday lives of patients. He was one of the most consequential nurse anesthesia leaders of his time. We present the foreword that he wrote for the first edition of this textbook in his honor.

Sass Elisha
Jeremy S. Heiner
John J. Nagelhout

FOREWORD FOR *NURSE ANESTHESIA*, FIRST EDITION

As a new century dawns, nurse anesthetists continue to provide the highest quality anesthesia services to their patients. To put this into perspective, consider that nurse anesthetists safely and compassionately administered anesthesia throughout the entire last century and even prior to that. The writings of Alice Magaw, published between 1899 and 1906, provide a noteworthy benchmark. Magaw detailed the use of chloroform and other anesthesia with the open-drop technique in more than 14,000 surgical cases without a single fatality attributable to anesthesia. She was the first nurse anesthetist to publish articles on the practice of anesthesia and was considered "the mother of anesthesia" during a time when surgeons selected nurses to specialize in anesthesia to provide greater safety for patients requiring anesthesia.

Many pharmacologic and technologic changes in anesthesia have occurred, however, since those noble beginnings. The chapter titles of this textbook serve as an atlas to this expanded knowledge base: "Clinical Monitoring in Anesthesia," "Anesthesia Equipment," "Pharmacokinetics," "Inhalation Anesthetics," "Intravenous Induction Agents," "Local Anesthetics," "Opioid Agonists and Antagonists," and "Neuromuscular Blocking Agents, Reversal Agents, and Their Monitoring," to name a few. Look at the specialty components of anesthesia contained in this book: "Cardiac Anesthesia," "Respiratory Anesthesia," "Thermal Injury and Anesthesia," "Trauma Anesthesia," "Outpatient Anesthesia," "Regional Anesthesia," "Anesthesia for Ophthalmic Procedures," "Anesthesia and Orthopedics," "Anesthesia for Ear, Nose, Throat, and Maxillofacial Surgery," "Anesthesia and Laser Surgery," and the list goes on. The continuum for practice in the twenty-first century is that of professionals learning anew how to ensure the best possible care for their patients.

When Agatha Hodgins and other nurse anesthetist pioneers gathered in a classroom in the anesthesia department of the University Hospital of Cleveland on June 17, 1931, they established what was to become the American Association of Nurse Anesthetists (AANA). This group sought to place better-qualified people in the field, to keep those already in nurse anesthesia abreast of modern developments, and to give protection and recognition to this group of professionals.

When the AANA values statement was adopted in 1995, it was not surprising that it reflected this earlier philosophy. The AANA values the following:

- Its members and the advancement of the profession of nurse anesthesia
- Quality service to the public through diverse practice settings based on collaboration and personal choice
- Integrity, accountability, competence, and professional commitment
- Scientific inquiry and contributions to the fields of anesthesiology, nursing, and related disciplines
- Participation in the formation of healthcare policy.

These value statements are supported by knowledgeable practitioners ever in pursuit of their craft.

Nurse Anesthesia is a textbook that builds on a formidable knowledge base and draws on the expertise of CRNAs and other professionals practicing in today's fast-paced, ever-changing environment. I look upon this volume as a means to demonstrate the profession's growth and encourage CRNAs and student nurse anesthetists to read it and reflect upon the dynamic field they have chosen.

I would like to close with one of my favorite quotations from Ralph Waldo Emerson, which I believe reflects all professionals on their prospective journeys:

> *To laugh often and much; to win the respect of intelligent people …;*
> *to earn the appreciation of honest critics …;*
> *to find the best in others …;*
> *to leave the world a bit better. … Bon voyage.*

John F. Garde, MS, CRNA, FAAN

PREFACE

Nurse anesthesia education and clinical practice continue to evolve at a rapid pace. Our professional degree has moved to the doctoral level, and the requisite knowledge needed to provide safe patient care is increasing exponentially. Due to the complexity of modern surgical procedures, ensuring the highest-quality outcomes requires the need for lifelong learning. Anesthesia practice has expanded beyond the traditional surgical settings to include interventional procedures, pain management, and non–operating room anesthetics. The objective of this new edition is to integrate the vast amount of current knowledge to help guide clinical practice.

Technologic innovations that allow this textbook to be used in traditional and various electronic formats are now commonplace. We approach the seventh edition of *Nurse Anesthesia* with a clear intent to bridge these platforms while remaining true to our educational objectives. Since the conception of the first edition of this text more than two decades ago, we continue to be guided by our original vision to fulfill the need for scientifically based, clinically oriented work on which anesthesia practitioners and learners can rely to deliver excellent patient care.

Our intent is to harness the vast knowledge that nurse anesthetists bring to clinical practice and provide a comprehensive, evidence-based resource for continuous learning. We are tremendously gratified that this textbook has become the seminal work for our specialty. *Nurse Anesthesia* is included among the Library of Congress's essential nursing textbooks for medical libraries throughout the United States and in national digital resource databases such as Elsevier's Clinical Key for Nursing. We reach an international audience of nurses and nurse anesthetists and are always pleased when we hear of the positive impact we are having on anesthesia practice worldwide.

We are especially grateful to all of our new and returning authors who bring a wealth of expertise and experience to their respective areas. The majority of clinical anesthesia continues to be provided by nurse anesthetists, and this textbook is a testament to the leadership we bring to academic and clinical nursing. Each chapter has been extensively reviewed and revised to contain the most salient information available. The newest concepts, techniques, and areas of controversy in anesthesia are discussed in detail. Providing effective anesthesia must be viewed as part of a therapeutic continuum of care. For this reason, we have intentionally included the latest medical and surgical information available from the specialties that impact our practice. Integrating new technology and knowledge in the basic sciences into clinical practice has allowed nurse anesthetists to continue to evolve as leaders in providing safe and comprehensive care. We have included new chapters on a wide variety of topics, including patient-centered care, cultural competence and nurse anesthesia practice, infection control and prevention, anesthesia for transplant surgery and organ procurement, chronic pain physiology and management, and crisis resource management and patient safety.

Producing an educational resource of this size and complexity would not be possible without the dedication of our authors and a broad array of experts. We proudly carry over from the previous editions hundreds of anatomic figures that were specially hand-drawn for this text by renowned medical illustrator William E. Loechel. We would like to express our gratitude to the staff at Elsevier who work tirelessly to produce this textbook. This book would not exist without their knowledge, expertise, and enthusiasm. A special thank you to Sonya Seigafuse, Executive Content Strategist; Laura Selkirk, Senior Content Development Specialist; and Manikandan Chandrasekaran, Senior Project Manager.

We would also like to acknowledge the contributions of Karen Plaus, PhD, CRNA, FAANA, FAAN as the coeditor of the first five editions of this text. Dr. Plaus has devoted her career to educating nurse anesthetists and advancing our specialty. Her decades-long achievements on the national and international levels continue to be instrumental in making nurse anesthesia a vital specialty for delivering high-quality health care. Finally, we would like to acknowledge all of the brilliant authors who have contributed to the creation of this book in past editions.

Sass Elisha
Jeremy S. Heiner
John J. Nagelhout

CONTENTS

1

Nurse Anesthesia: A History of Challenge

Bruce Evan Koch

It is fitting to open a text on nurse anesthesia with a history chapter. Nurses were the first professional group of anesthetists in the United States. Since the discovery of anesthesia in 1846, nurses have provided the majority of anesthetics in this country. Nurses have contributed to incremental progress to improve clinical anesthesia, patient safety, science, education, and public policies supporting anesthesia. Today's American Certified Registered Nurse Anesthetists (CRNAs)* receive state-of-the-art education, are granted a wide scope of practice, and have access to reliable and affordable malpractice insurance. These accomplishments are the result of more than a century of clinical accomplishments and concerted group efforts. By educating others about the history and achievements of CRNAs that created the foundation of our profession, the next generation of nurse anesthetists can learn from the experiences of the past and continue to move our profession toward excellence.

THE DISCOVERY OF MODERN ANESTHESIA

Decades before 1846, people were aware that inhaling nitrous oxide or diethyl ether could produce euphoria. In the late 18th century, the English scientists Joseph Priestley and Humphrey Davy experimented on themselves and even partied with these substances. Davy famously speculated that nitrous oxide "may probably be used with advantage during surgical operations."[1] At the same time, American medical students used ether and nitrous oxide recreationally.

However, almost 40 years would pass before they attempted to use these agents as adjuncts to surgery. A physician from Georgia named Crawford Long used diethyl ether for the removal of a small cyst in 1842, but he did not report his findings. At least two other men, the Massachusetts physician Charles Jackson and the Connecticut dentist Horace Wells, experimented with ether and nitrous oxide. Four years after Long's use of ether, on October 16, 1846, the Boston area dentist William T.G. Morton conclusively demonstrated the use of ether for surgical anesthesia in an operating room (now memorialized as the "Ether Dome") at Massachusetts General Hospital. This event was so important that the surgeon John Collins Warren, who had witnessed many prior failed attempts, reportedly exclaimed, "Gentlemen, *this* is no humbug." Another eminent surgeon who had been in attendance stated, "I have seen something today that will go around the world."[2] From their vantage point, optimism seemed justified; however, another half century would pass before the promise of painless surgery would be substantially fulfilled.

*Certified Registered Nurse Anesthetist (CRNA) is the descriptor used throughout this chapter interchangeably with nurse anesthetist and nurse anesthesiologist.

From the outset, Morton's discovery caused problems. People realized its monetary and historic value. Morton attempted to disguise ether so he could profit from it and applied for a patent. Long, Jackson, and Wells all claimed credit for Morton's discovery. The four men battled for years. The physician and writer Oliver Wendell Holmes Sr. (father of the Supreme Court justice) wrote to Morton: "Everybody wants to have a hand in a great discovery… All I want to do is give you a hint or two as to names." Holmes suggested "anesthesia from the Greek for insensible." The term *anesthesia* had been in use before to denote parts of the body benumbed but not paralyzed. Holmes only borrowed the word for the new state of being, though he has received credit for coining it.[3] As the anesthesiologist Robert Dripps noted, "Anesthesia was placed under a cloud."[4]

Nineteenth-century anesthesia was problematic in other, more important ways. Careless anesthetists vexed surgeons and infection-plagued patients and delayed progress in the field of anesthesia for decades. The historian Ira Gunn termed this era "the period of the failed promise."[5]

In the 19th century, physicians wanted to operate but they showed little interest in anesthesia as a medical specialty.[6] James Gather, the pioneer physician anesthetist, gave one explanation for this medical disinterest: "So intense had been the interest in surgery that anesthetics had been used only as a means to an end, and this fully explained the attitude of the profession on this subject in America at the present time." Physicians at the time could not make a living providing anesthesia anywhere outside a major city,[7] and anesthesia was deemed by some as unworthy of a physician's intellect.[8] The historian Marianne Bankert agreed: "Apart from the few physicians who had a genuine intellectual interest in anesthesia, it would also take years for the economics of anesthesia to make it an attractive area for their colleagues—if at first, only as a supplemental source of income."[9]

The work of anesthesia was provided by others: "Students, nurses, newly graduated physicians, specialists in other fields, and even custodians were called upon to be *etherizers*."[10] "Anesthesia could be anybody's business," wrote Virginia S. Thatcher.[11]

Lack of attention led to a degradation of knowledge and technique: The glass inhaler (Fig. 1.1) that Morton commissioned for his 1846 demonstration, and which worked so well, "was abandoned in favor of a small bell-shaped sponge, which was saturated with ether and applied directly over the nose and the mouth of the patient."[11] Not surprisingly, ether pneumonia resulted. Some surgeons turned to chloroform, which had been discovered to have anesthetic properties by James Simpson in England in 1847. "But, very soon, a death occurred from chloroform, then another and another in quick succession. This led to its more careful and restricted use by some surgeons, to its total abandonment by others, but in 1855, the general mass of surgeons and physicians still continued its use…."[12] Thatcher, the first historian of nurses as anesthetists, cited

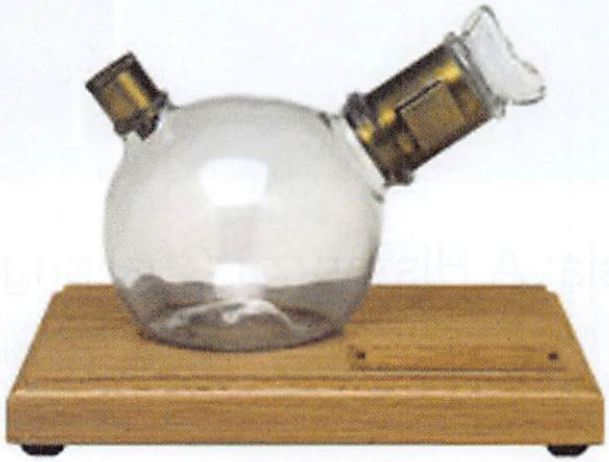


Fig. 1.1 Morton's inhaler, a replica of the inhaler used by William Morton to demonstrate the anesthetizing capacity of ether on October 16, 1846.

one physician who, in 1859, wrote "that most of the fatal cases can be traced to a careless administration of the remedy."[13]

Carelessness in anesthesia persisted for decades. A shocking example was recorded in 1894 by Harvey Cushing, the founder of neurosurgery. Cushing was a student at Harvard Medical School when he wrote:

> *My first giving of an anaesthetic was when, a third-year student, I was called down from the seats and sent in a little side room with a patient and an orderly and told to put the patient to sleep. I knew nothing about the patient whatsoever, merely that a nurse came in and gave the patient a hypodermic injection. I proceeded as best I could under the orderly's directions, and in view of the repeated urgent calls for the patient from the amphitheater it seemed to be an interminable time for the old man, who kept gagging, to go to sleep. We finally wheeled him in. I can vividly recall just how he looked and the feel of his bedraggled whiskers. The operation was started and at this juncture there was a sudden great gush of fluid from the patient's mouth, most of which was inhaled, and he died. I stood aside, burning with chagrin and remorse. No one paid the slightest attention to me, although I supposed I had killed the patient. To my perfect amazement, I was told it was nothing at all, that I had nothing to do with the man's death, that he had a strangulated hernia and had been vomiting all night anyway, and that sort of thing happened frequently and I had better forget about and go on with the medical school. I went on with the medical school, but I have never forgotten about it.*

Not surprisingly, surgeons began to appreciate the need for professional anesthetists. The need, as Thatcher defined it, was for anesthetists who would "(1) be satisfied with the subordinate role that the work required, (2) make anesthesia their one absorbing interest, (3) not look on the situation of anesthetist as one that put them in a position to watch and learn from the surgeon's technic, (4) accept the comparatively low pay, and (5) have the natural aptitude and intelligence to develop a high level of skill in providing the smooth anesthesia and relaxation that the surgeon demanded."[11] As a result of medical disinterest, poor delivery of anesthesia, and an overwhelming need, nurses were asked to administer anesthesia.

HISTORICAL ANTECEDENTS OF THE NURSE AS AN ANESTHETIST

The Civil War provided the first opportunity for nurses to assume the duties of anesthetist. Evidence is scant but found in three different accounts. Mrs. Harris from Baltimore, Maryland, took chloroform and stimulants to the Battle of Gettysburg. Harris "penetrated as near as possible to the scene of the conflict, ministering as much as in her power to the stream of wounded that filled the cars...."[14] It is not known whether Mrs. Harris was a nurse. A second report connects an unnamed "nurse in attendance" with having administered chloroform to a Union army soldier.[15] The third and most convincing example comes from Catherine S. Lawrence, a native of Skaneateles, New York, who wrote a 175-page autobiography in which she recorded administering anesthesia as a Union army nurse. Lawrence described her duties at a hospital outside Washington, DC, during and after the second battle of Bull Run (1863). She administered medications, resuscitated with restoratives such as ginger, tied sutures around arteries, and administered chloroform. "I rejoice that the time has arrived that our American nurses are being trained for positions so important. A skillful nurse is as important as a skillful physician."[16-18]

The First Civilian Nurses to Practice Anesthesia

Nurses in civilian hospitals began to practice anesthesia during the westward expansion that followed the Civil War. Surgeons taught Catholic hospital Sisters the rudiments of administering ether.[19] Sister Mary Bernard in 1877 entered St. Vincent's Hospital in Erie, Pennsylvania, to train as a nurse and is the earliest known example. Between 1860 and 1900, surgeons throughout the Midwest repeated this practice, training Sisters and secular nurses to administer ether. The Franciscan Sisters, who were active in the building and staffing of St. John's Hospital in Springfield, Illinois, were particularly successful in preparing hospital Sisters to become nurse anesthetists and sending them out to other midwestern hospitals. Having been prepared by another community of the Sisters of St. Francis (Syracuse, New York), Sister Mary Erhard went to Hawaii in 1886, where she administered anesthesia and performed other nursing duties on the island of Maui for approximately 42 years.

The St. Mary's Experience

In the summer of 1883, a very destructive tornado swept through Rochester, Minnesota. In its wake, the tornado "left an idea in the mind of the mother superior of the Sisters of St. Francis." During rescue efforts, she paid a visit to Dr. W.W. Mayo and asked: "Did he not think it would be well to build a hospital in Rochester?" Dr. Mayo thought the town too small to support a hospital, but "Mother Alfred had made up her mind. Quietly, she overruled the Old Doctor's objections and said that if he would promise to take charge of a hospital, the sisters would finance it." St. Mary's Hospital was built and opened, and although hospitals ranked low in the public's mind due to poor anesthesia and deadly infections, by 1904, it had expanded twice to keep up with demand. The hospital has endured until today as the Mayo Clinic. The Mayos (William Sr., William Jr., and Charles) won international acclaim for pioneering surgery.

But how did the Mayos handle the administration of anesthesia? According to Helen Clapsattle, the Mayo family historian, they were aware of its dangers but, unlike their colleagues on the East Coast, they were quick to embrace the open drop method of ether when it was brought to the United States from Germany. They also differed from East Coast physicians in one other respect: "In employing a permanent full-time anesthetist, and that a nurse, the Mayo's were unusual if not unique. In other hospitals anesthetizing was one of the duties of the interns."

Why would they give the job to a nurse? The Mayos had given the job to a nurse "in the first place through necessity; they had no interns. When the interns came, the brothers decided that a nurse was better suited to the task because she was more likely to keep her mind on it, whereas the intern was naturally more interested in what the surgeon was doing."[20]

Nurses won the Mayos' admiration by improving anesthesia care. Alice Magaw could discuss "a hundred and one details as to signs of sufficient anesthesia and ways of recognizing and preventing impending disaster." Magaw, along with her pupil Florence Henderson, refined and advocated the dripping of ether. Ether anesthesia required vigilance and careful attention to detail and to the psychological care of patients to minimize the agitation that often led to disasters like the one previously described by Harvey Cushing.

Henderson described how this was done: "A modified Esmarch inhaler, which is covered with two layers of stockinet, is used.... With the mask held about an inch from the face the ether is dropped upon it, slowly at first, and the patient is asked to breathe naturally through the nose. Then the mask is gradually lowered, and the rapidity of the dropping increased, care being taken not to give the ether fast enough to cause a sensation of smothering or suffocation. As soon as the jaw relaxes the head is turned to one side, because the patient usually breathes more easily with the head in this position." This was quite a contrast to the "crude" methods of most early anesthetizers, and it was successful. Nancy Harris and Joan Hunziker-Dean, who investigated Henderson's life, concluded that "through a delicate balance of interpersonal skills and technical expertise, she was able to essentially eliminate the excitement phase associated with the induction of ether anesthesia and consistently used a fraction of the usual dose. She demonstrated to all who observed that the administration of ether anesthesia could be elevated to an art form."[21]

Magaw and Henderson improved the safety of anesthesia care. Magaw accounted for the delivery of over 14,000 anesthetics "without an accident, the need for artificial respiration or the occurrence of pneumonia or any serious results."[22-26] These were not minor operations. Included were anesthetics for abdominal, intraperitoneal, gynecologic, urologic, orthopedic, ophthalmic, head and neck, and integument operations. Some were even conducted with the patient in the prone position.[23] Magaw and Henderson introduced better teaching methods, too. Early anesthesia education has been described as "on the spot training of any person available."[27] At Mayo, sometimes the "nurses stayed for 2 or 3 months and learned to give ether under supervision."[28] Surgeons who visited from Minneapolis, Baltimore, Chicago, the state of Iowa, and England "sent selected nurses to Rochester to observe Magaw and other nurse anesthetists at St. Mary's Hospital at their work."[11] Charles Mayo was so impressed by Magaw that he named her "The Mother of Anesthesia." To this day, the American Association of Nurse Anesthetists (AANA) confers on an outstanding practitioner an award named for Alice Magaw.

The Great War, a Small Battlefield

Nurse anesthetists played a very large role during World War I. Their involvement began in 1913, just 4 years before the United States became involved militarily, and lasted until the armistice in 1918.

When America entered the war, the Army Nurse Corps numbered 233 regular nurses; it would grow to 3524 nurses by 1918. The number of nurses who actually practiced anesthesia is unknown because at the time nurse anesthetists formed part of the general nursing staff.[28] However, nurse anesthetists were credited with introducing nitrous oxide/oxygen and teaching its administration to the English and the French.[29] As a result of the superior performance of nurse anesthetists, both the army and the navy sent nurses for anesthesia training for the first time.

Several outstanding World War I–era nurse anesthetists have been remembered because they wrote of their work. Nurse anesthetists spent countless hours etherizing wounded soldiers as they arrived in "ceaseless streams for days at a time after battles," wrote Mary J. Roche-Stevenson. "Work at a casualty clearing station came in great waves after major battles, with intervals between of very little to do.... Barrages of gun fire would rock the sector for days, then convoys of wounded would begin to arrive by ambulance. Night and day this ceaseless stream kept coming on.... The seriously wounded, especially the ones in severe shock, were taken to a special ward, given blood transfusions and other treatments in preparation for surgery later. From the receiving tent, the wounded were brought to the surgery, put on the operating tables stretcher and all, given an anesthetic, operated upon, picked up on their stretcher, and loaded on hospital trains for evacuation to base hospitals."[30] Terri Harsch,[28] who described the works of Roche-Stevenson and others such as Sophie Gran Winton, reported that 272 nurses were killed during the war.

In a paper about Miss Nell Bryant from the Mayo Clinic, who was the sole nurse anesthetist stationed at Base Hospital Number 26,[31] we learn that chloroform and ether were in use, the physiology of shock was poorly understood, oxygen and nitrous oxide were given without controlled ventilation, and venipuncture involved a surgical cutdown.

Anne Penland was a nurse anesthetist with the Presbyterian Hospital of New York unit at Base Hospital Number 2. She had the honor of being the first US nurse anesthetist to go officially to the British front, where she so won the confidence of British medical officers that the British decided to train their own nurses in anesthesia, ultimately relieving more than 100 physicians for medical and surgical work. Several hospitals were selected for this training of British nurses, including the American Base Hospital Number 2, with Penland as the instructor.[9]

Commenting in the *Bulletin of the American College of Surgeons*, Frank Bunts wrote: "The (First) World War demonstrated beyond any question the value of the nurse anesthetist."[32] George Crile speculated that "if the Great War had gone on another year, the British army would have adopted the nurse anesthetists right in the middle of the war."[33] Looking back after World War II, Lt. Colonel Katherine Balz, deputy chief of the Army Nurse Corps, credited nurse anesthetists for the fact that 92% of "battle wounded who reached Army hospitals alive were saved."[34]

The Proliferation of Nurse Anesthetists

The first recognition of the value of formalized education also occurred around this time. Isabel Adams Hampton Robb, a leading pioneer in nursing and the first superintendent of the Johns Hopkins School of Nursing, which opened in 1889, had, in 1893, published a nursing textbook titled *Nursing: Its Principles and Practices for Hospital and Private Use*; this textbook included a chapter titled "The Administration of Anaesthetics." By 1917, as a result of the "superior quality of anesthesia performed by nurse anesthetists,"[24] they were given the responsibility for surgical anesthesia at Johns Hopkins Hospital in Baltimore, where a training program was established under the direction of Ms. Olive Berger. Elsewhere, four postgraduate programs were developed: at St. Vincent's Hospital in Portland, Oregon (1909)[25]; at St. John's Hospital in Springfield, Illinois (1912); at New York Postgraduate Hospital in New York City (1912); and at Long Island College Hospital, Brooklyn, New York (1914).[11] Other nurse anesthesia programs were developed as part of the undergraduate nursing curriculum as a specialty option.

The Lakeside Experience

In 1900, Agatha Hodgins (Fig. 1.2), a Canadian nurse, went to Cleveland to work at Lakeside Hospital. Dr. George Crile chose her to become his anesthetist in 1908. Together with Crile, Hodgins pioneered the use of nitrous oxide/oxygen anesthesia, proved its superiority over ether for trauma cases in World War I, and opened and led a prominent school for nurse anesthetists that endured the first major challenge from physician anesthetists. In 1931, Hodgins founded the AANA.

Fig. 1.2 Agatha Hodgins, an educator and founding president of the American Association of Nurse Anesthetists, reintroduced (with other American nurse anesthetists) the use of nitrous oxide for battlefield surgery during World War I in Europe.

Hodgins's primary interest was in education. Like its predecessor, the St. Mary's Hospital in Rochester, Minnesota, the Lakeside Hospital in Cleveland, Ohio, was the recipient of many requests for anesthetist training from both physicians and nurses. According to Thatcher, "Visiting surgeons eager to emulate the Lakeside methods customarily bought a gas machine (the Ohio Monovalve) and then sent a nurse to Cleveland to find out how it worked."[11] Hodgins recalled, "The number of applicants increased so rapidly that we felt some stabilizing of work necessary and the matter of a postgraduate school in anesthesia presented itself." In 1915, Hodgins opened a school at Lakeside Hospital.

The Lakeside School was not the first formal postgraduate anesthesia educational program; that honor belongs to St. Vincent's Hospital in Portland, Oregon. But the Lakeside School is the only program for which original records still exist. There were admission requirements, the course included both clinical and didactic components, tuition was charged, and a diploma was granted. "The department of anesthesia encompassed the school, both being under the charge of Agatha Hodgins as chief anesthetist. She, in turn, worked under the jurisdiction of the superintendent of the hospital and the chief surgeon. For the supervision of the students, she had 1 or 2 assistants until 1922 when the number was increased to 3."[11]

The Lakeside Hospital School prompted the establishment of 54 similar programs at major hospitals across the country.[24] The considerable impact of the Lakeside School on the evolution of nurse anesthesia education into a more formalized, scientifically based discipline can thus be seen.

ANESTHESIA: MEDICINE, NURSING, DENTISTRY, OR WHAT?

Nurse anesthetists appeared to be on the threshold of national acceptance when a New York attorney published a derisive article, titled "The Case Against the Nurse-Anesthetist," in which he introduced the idea that anesthesia was by law exclusively the practice of medicine. He admonished "self respecting nurses to turn their attention to other matters—perhaps urinalysis."[35] This article, published in 1912, presaged efforts to legislate or litigate nurse anesthetists out of existence. And it set the tone for much of the vitriol directed by physician anesthetists toward CRNAs in the years to come. Although few physicians chose to specialize in anesthesia before World War II, one who did, Francis Hoeffer McMechan—a Cincinnati native—began a crusade around 1911 to claim the field solely for physicians. Through publishing and speaking, McMechan investigated the high-profile Lakeside School and its famous surgeon, George Crile. He alleged that anesthesia was the practice of medicine, and he petitioned the Ohio Medical Board to take action. McMechan considered Ohio a "pivotal state in the national fight for the preservation of the status of the anesthetist as a medical specialist."[36]

In a letter to Crile in 1916, the board claimed that no one other than a registered physician was permitted to administer anesthesia. The board ordered the Lakeside Hospital School of Nursing to cease its anesthesia program or lose its accreditation. Not wanting to be responsible for the loss of the school's accreditation, Crile obeyed the order, pending the outcome of a hearing conducted in 1917. At the hearing, Crile took the position that Lakeside Hospital was only following the lead of many of the major clinics in the country. (Recall Alice Magaw at the Mayo Clinic.) Crile managed to persuade the board of medicine to lift its order, and he was able to reinstitute his nurse anesthesia educational program and his use of nurse anesthetists.

To protect nurse anesthetists, Crile took an additional step. In 1919, together with supporting physicians, he "introduced a bill into the (Ohio) legislature to legalize the administration of anesthetics by nurses."[4,11] An amendment to the legislation stated that nothing in the bill "shall be construed to apply to or prohibit in any way the administration of an anesthetic by a registered nurse *under the direction of and in the immediate presence of* (emphasis added) a licensed physician," provided that such a nurse had taken a prescribed course in anesthesia at a hospital in good standing.[37] Physician supervision of nurse anesthetists, introduced here, would recur many times over.

In 1916, Louisville (Kentucky) Society of Anesthetists passed a resolution proclaiming that only physicians should administer anesthesia. The attorney general concurred, and the Kentucky State Medical Association followed with a resolution stating that it was unethical for a physician to use a nonphysician anesthetist or to use a hospital that permitted nurses to administer anesthesia. These events prompted the surgeon Louis Frank and his nurse anesthetist Margaret Hatfield to ask the state board of health to join them in a lawsuit against the Kentucky State Medical Association. They lost in the lower court, but on appeal they won. In 1917, Judge Hurt of the Kentucky Court of Appeals not only confirmed the right of nurses to administer anesthesia but also enunciated clearly that state licensure was meant to protect consumers, not professionals.

These two cases showed physicians that they could not rely on the courts; however, they were not deterred. Physician anesthetists in California brought suit against Dagmar Nelson, a nurse anesthetist, for practicing medicine without the proper license. The *Chalmers-Francis v. Nelson* case was decided in favor of Nelson at each level of the California civil courts. The California Supreme Court ruled that the functioning of the nurse anesthetist under the supervision of and in the direct presence of the surgeon was the common practice in operating rooms; therefore the nurse anesthetist was not diagnosing and treating within the meaning of the medical practice act.[38,39]

At the time, nurse anesthetists welcomed and embraced the concept of physician supervision because it was couched within statutes that, for the first time, gave them legal status. Gene Blumenreich, who has written extensively on the legal history of anesthesia, noted: "A number of states adopted statutes recognizing the practice of nurse anesthetists. Typically, these statutes followed the formulation in *Frank*

v. South and provided that nurse anesthetists were to work under the 'supervision' or 'direction' of a physician." However, the statutes did not define supervision. "It is clear that the legislation was not attempting to create new duties and responsibilities for the supervising physician, but merely to describe what was already occurring practice…to explain why nurse anesthetists were not practicing medicine."[40]

ORGANIZING NATIONALLY: "WE WHO ARE MOST INTERESTED"

In 1926, Agatha Hodgins called together a small group of Lakeside Hospital alumnae to form a national organization. Hodgins had been an educator since World War I, and she sought strength in numbers to address problems related to education. One hundred thirty-three names were submitted, and tentative bylaws were drawn up. According to Ruth Satterfield, who was an eminent CRNA educator and the first nurse appointed as Consultant to the Army Surgeon General, "much of what she (Hodgins) said fell on deaf ears."[41] The association failed to thrive. Five years would pass before several problems would coalesce and force the national organization of nurse anesthetists to come to life.

Physician opposition to nurse anesthetists was one factor in this development. For example, in 1929, the California nurse anesthetists organized after the Board of Medical Examiners alleged that nurse anesthetist Adeline Curtis was practicing medicine illegally. Curtis, a natural public speaker, went on the road with this refrain: "…we can get nowhere without an organization. We're in the minority of course but we must organize."[42] California held its first meeting February 3, 1930.[43] Other states followed suit, and by the end of the 1930s, 23 had established organizations.

Economics brought nurse anesthetists together as well. This era of organization occurred during the Great Depression, and Hodgins noted in 1935 that "the strongest objection of physicians during this period was against those nurse anesthetists who were working on a fee for service basis."[44] Hanchett, who examined the *Chalmers-Francis v. Nelson* case (1933), concluded that the plaintiff California physicians were motivated by economic factors.[45] Thatcher observed that "Miss Hodgins' concept (of an organization) might never have been sparked into action, and organizations of nurse anesthetists might have stayed at the local level if the collapse of the nation's economy had not revived the physician anesthetist's interest in protecting his income by eliminating competition from nurses…."[11]

It was the poor state of anesthesia education that most motivated Hodgins. In 1931, she wrote the following to Curtis, who was embroiled in the California dispute: "My chief interest is in education."[46] So in the face of rising physician opposition, deteriorating economics, and the pressing need to reform education all compounding each other, Hodgins tried again. The National Association of Nurse Anesthetists (NANA) was born on June 17, 1931. Its name would be changed to the American Association of Nurse Anesthetists in 1933. The first meeting was held in a classroom at Lakeside Hospital and was attended by 40 anesthetists from 12 states.[47]

Right away, the new association set its sights on improving the quality of anesthesia by raising educational standards. The new president, in a letter to Marie Louis at the American Nurses Association (ANA), wrote: "It is because of the increasing number of nurses interested in the particular work and growing realization of difficulties existing because of insufficient knowledge of, and proper emphasis on, the importance of education, that we who are most interested are taking the steps to insure our ability to define and help maintain the status of the educated nurse anesthetist."[48] An education committee was formed. Chaired by Helen Lamb, the committee crafted "recommended" curriculum standards for schools and ratcheted them up in 1935 and again in 1936.

The fledgling association was weak with few members and little money. It could not hold its first national meeting for 3 years, much less advance an agenda of education reform. In that period, Hodgins sustained a heart attack and "for all practical purposes bowed out as administrative leader." Gertrude Fife (Fig. 1.3) took over the day-to-day affairs. There grew the realization, attributed by Bankert to Lamb and the education committee, that the problems were of such magnitude that an alliance with a more influential professional association would be required. But which one?

Fig. 1.3 Gertrude Fife and Helen Lamb were among the highly motivated group who built the profession. Fife served as second president (1933–1935) and treasurer (1935–1950) of the National Association of Nurse Anesthetists and edited the *AANA Journal* (1933–1950).

Forming an alliance with a major professional organization would likely prove problematic, as divergent interests could collide and trust would be tested to its limit. The small and newly organized NANA would have to fight to maintain its independence while at the same time obtain much-needed support. According to historian Rosemary Stevens, the AANA "made overtures to the American Board of Anesthesiology (ABA) in 1938 which might have enabled the two movements to combine and the anesthesiologists to take on the responsibility of the nurses' training." But at the time, the ABA was struggling to emerge from under the wing of surgery, and "the nurses were summarily rejected."[49]

So, instead, with the guidance and support of the American Hospital Association, Fife and Lamb planned the first meeting, which was held in Milwaukee in 1933. They also crafted a highly centralized organization to efficiently address the association's concerns. Thatcher listed those concerns: "(1) building up the membership so that there would be a creditable showing at the Milwaukee meeting; (2) arranging a program; (3) getting a constitution and the bylaws revised; and (4) launching the association's educational program."

Membership was to be a privilege, a mark of distinction. The bylaws required that an active member have graduated from an accredited school of nursing, have passed the required state board examination, and maintain an active license. Importantly, an applicant must "have engaged for not less than three years in the practice of the administration of anesthetic drugs prior to 1934 and must be so engaged at the time of making application for membership."[50] As membership surpassed 2500, a survey of schools, using onsite surveyors, evaluated courses being taught. An Anesthesia Records Committee was formed to create a standardized anesthetic record, and the credential "Member

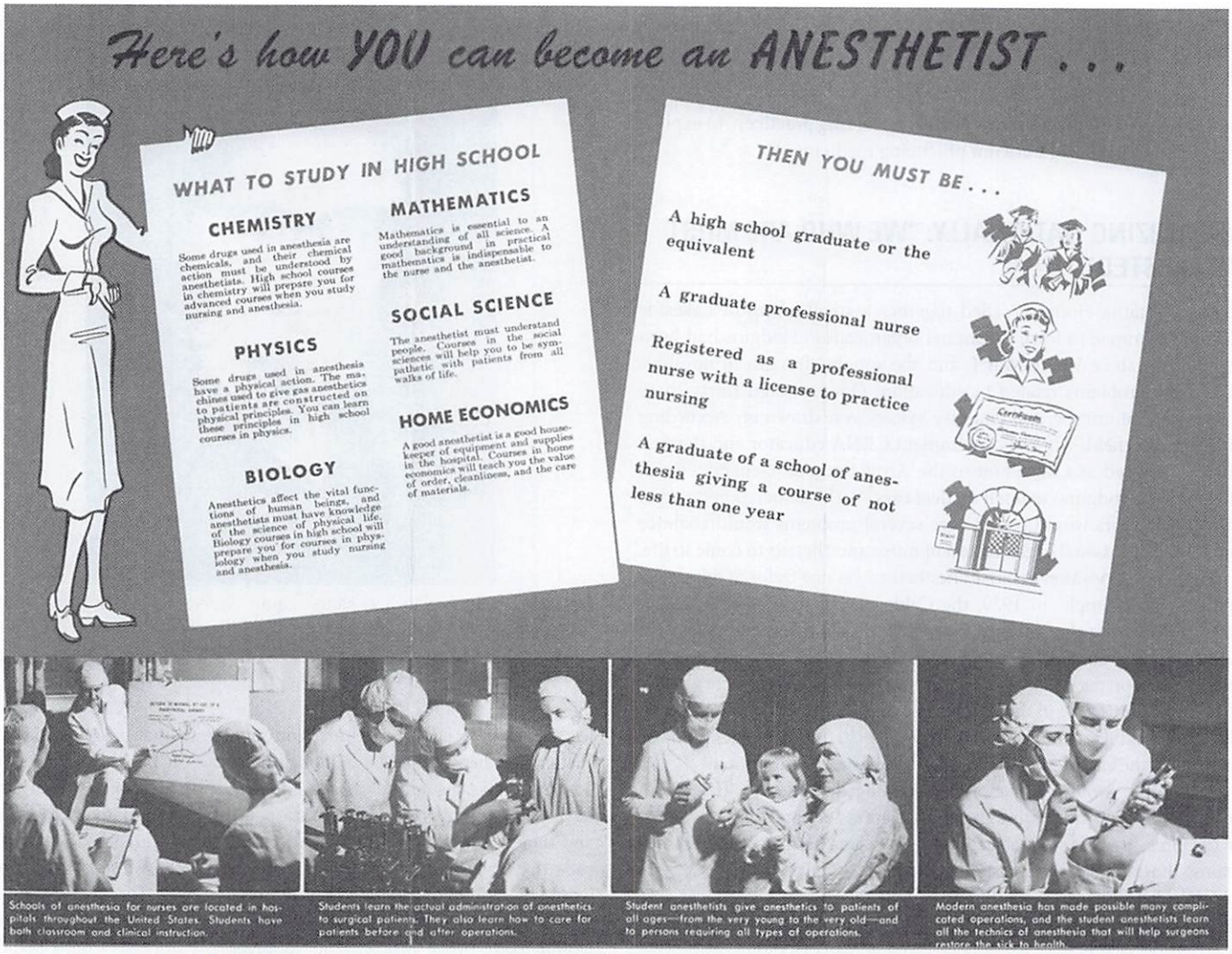


Fig. 1.4 This recruitment brochure was disseminated to schools of nursing to counteract the negative effect of antinurse anesthetist public relations.

of the American Association of Nurse Anesthetists" was implemented. These strides served to show that the profession had left its infancy. Then, World War II erupted and stalled further progress for the nurse anesthesia profession.

WORLD WAR II AND NURSE ANESTHETISTS

When World War II began, nurse anesthetists once again distinguished themselves. They served at home and in all theaters of operations. Mildred Irene Clark, who was originally from North Carolina, joined the army in 1938. Under army auspices, she graduated from Jewish Hospital in Philadelphia, where Hilda Salomon was program director. Clark was on assignment as a nurse anesthetist at the Schofield Barracks Hospital in Hawaii when Pearl Harbor was struck. Clark was among other nurse anesthetists on active duty who set up educational programs for preparing additional nurse anesthetists. Clark completed her career in 1967 as the chief of the Army Nurse Corps, the first nurse anesthetist to hold this position.

Annie Mealer, another notable army nurse anesthetist, was sent from Walter Reed Army Medical Center to the Philippines in 1941. She served as chief nurse and chief nurse anesthetist of the hospital on Corregidor. For 3 years, Mealer was held as a prisoner of war. Among the nurse anesthetists imprisoned with her were Denny Williams, Doris Keho, and Phyllis Arnold Iacobucci. They and 62 other army nurses were imprisoned until February 3, 1945.

Bankert quotes at length a letter Mealer later wrote in which she described her experiences. Mealer recalled housing President Quezon and his family, "giving anesthetics to one casualty after another" who "all needed help that only a nurse could give them." In Japanese custody aboard a troop ship, and sick with dengue fever, Mealer wrote, "I threw my cape down on the deck to lie on it and prayed that the wind would blow the fumes of the stale fish in another direction. I looked around at the nurses in the various uniforms of coveralls and skirts. They had grown slender as reeds but were smiling over some secret rumor about liberation—not realizing they had nearly three more years of hard work and starvation."[9]

The war effort greatly expanded the need for anesthetists in both military and civilian hospitals. Lt. Col. Katherine Balz, education consultant to the army, estimated that "approximately 15,000,000 patients were admitted to Army hospitals during the war, and something had to be done to provide the anesthesia services needed for these patients' care." In 1942, historian Stevens reported that nurse anesthetists outnumbered anesthesiologists by 17 to 1.[51] By the end of World War II, the Army Nurse Corps had educated more than 2000 nurse anesthetists, most (though not all) of whom were given an abbreviated 4- to 6-month curriculum patterned after that required by the AANA (Fig. 1.4).[52] Lt. Col. Balz recalled a situation in which some volunteer nurses were placed into anesthesia service after only 90 days of training! "At the end of that time, these volunteers were thrown into

a situation in which 100 operations were being performed every 24 hours…there were not enough hours in the day to care for the patients and at the same time provide for formal instruction. In this hospital, over 5,000 anesthetics were given during a six months' period, and not one death or complication occurred as a result of anesthesia."[53]

The increased needs and the shortened training period posed "extraordinary complications" for the AANA. The questionable quality of newly minted graduates had to somehow be addressed. To maintain standards, the AANA implemented a temporary "program of certification by exam and certification by waiver."[9] Accreditation of programs was postponed entirely.

Despite being ill, Hodgins sent these words of encouragement: "The immense and vital part all branches of medical service will play in this continuing task can—because of its greatness—be now only dimly conceived. They will in very truth be a 'green island' in 'the wide deep sea of misery' now encompassing the earth." These were among her last words. Hodgins passed away in 1945. Her gravesite is located on Martha's Vineyard in Massachusetts.[54]

As World War II drew to a close, the AANA's plans for instituting a certification examination for civilian membership were at last realized. The first examination was given in June 1945. It was completed by "90 women in 39 hospitals in 28 states, plus one in the Territory of Hawaii."[55] It would be hard to conclude that their "high type of service" during the two world wars did not account for this accomplishment. It would also place the AANA firmly in the position of arbiter of quality in nurse anesthesia.

Nationally, World War II was also associated with bringing about certain human rights advances. Jackie Robinson in 1947 played his first game for the Brooklyn Dodgers. President Truman integrated the armed forces in 1948, and the first male nurse was commissioned in 1955, a step attributed to nurse anesthesia. The first two male nurses commissioned in the Army Nurse Corps were nurse anesthetists Edward L.T. Lyon of New York and Frank Maziarski of Washington, and the latter eventually became the 60th president of the AANA.[11,56] The AANA admitted its first black member in 1944 and its first male member in 1947.

A SHORT-LIVED PEACE FOR NURSE ANESTHETISTS AND THE NATION

After the war, the number of physicians in anesthesia greatly increased. In 1940, there were only 285 full-time anesthesiologists, 30.2% of whom were certified; in 1949, there were 1231 anesthesiologists, 38.3% of whom were certified.[57] Gunn attributed the increase to wartime medical experiences "alerting physicians to the potential of anesthesia as a specialty.[58] Bankert listed as causes "the increased complexity of anesthetics, but also…a military structure that encouraged medical specialization and a GI Bill that supported medical residencies."[8] The country produced more physicians, and many were drawn to anesthesiology.

Upon returning from military service, "medical (physician) anesthetists—*many of them trained in the Armed Services*—(in an effort) to establish themselves in a civilian economy, brought about a resurgence of activity against the nurse anesthetist."[11] One activity was to render "historically invisible" the contributions of nurses. For example, the 1946 centennial celebration of ether at the Massachusetts General Hospital lauded anesthesiologists but made no mention of nurse anesthetists. Thomas Keys published *The History of Surgical Anesthesia*, a widely referenced book that recent analysis has shown was deliberately meant to write nurse anesthesia out of existence.[59] Bankert listed other similar efforts: "a myth is launched of the early superiority of British anesthetists—a land, so the story goes, which was never so foolish as to allow nurses to administer anesthetics; the national association of physician-anesthetists backdates its founding (from 1936) to 1905; a new word (*anesthesiologist*) is coined in the 1930s to distinguish the work of physician-anesthetists from nurse-anesthetists; 'historical' studies are published with titles such as *The Genesis of Contemporary Anesthesiology*, as though nothing of significance occurred in the field until the 1920s, when physician-anesthesia began to be effectively organized."[8] Anesthesiologists launched a nationwide public relations effort to denigrate nurse anesthetists. In 1947, several "major articles" appeared in *Look Magazine, Hospital Management, Reader's Scope,* and *This Week.* One excerpt railed: "Bad anesthesia causes more operating-room deaths than surgery. Now many hospitals have physician-anesthetists to protect you." Fear was a part of this campaign: "Until the operating rooms of our hospitals are brought into line with the clear requirements of modern anesthesiology, hundreds of Americans will continue to die needlessly on operating tables, sacrificed to ignorance and incompetence."[8] No evidence was offered to support this opinion. The first study of anesthesia-related outcomes would not be conducted until 1954.

These negative public relations efforts did not accomplish their goal. Surgeons, the public, and "often the anesthesiologist himself" were not dissuaded from trusting nurse anesthetists. However, they did "discourage many capable nurses from entering the field," prompting the AANA to promote the profession and recruit nurses who had been frightened away.[11] Anesthesiologists then undertook the first quality of care study in anesthesia. The results, according to Gunn, "shocked and dismayed many anesthesiologists."

The study, which was published in 1954 by Beecher and Todd, was the first prospective analysis of anesthesia outcomes. Ten university hospitals contributed data from approximately 600,000 anesthetics. The death rate for patients treated by nurse anesthetists was half that of anesthesiologists. There was no difference in physical status among the patients treated by the groups of providers. However, that did not stop the authors from surmising (without evidence) that anesthesiologists were anesthetizing more complex surgical cases.[60] Not surprisingly, more quality comparisons would be conducted in the coming decades.

In 1948, for example, Olive Berger at Johns Hopkins reported 480 anesthetics for repair of cyanotic congenital heart disease in infants and children, including tetralogy of Fallot.[61] Betty Lank at Boston Children's Hospital pioneered the use of cyclopropane in pediatric anesthesia.[62] After the United States committed troops to South Korea, the National Women's Press Club named the army nurse as its Woman of the Year (1953). An army nurse anesthetist, Lt. Mildred Rush from Massachusetts, accepted the award on behalf of all army nurses.

It was the Korean War that ultimately led to the accreditation of all nurse anesthesia education programs. During the war itself, the AANA had begun accrediting programs, but it had little authority and no way to reform or close underperforming schools. To enforce proper standards, the AANA successfully appealed to the Department of Health, Education, and Welfare for recognition as the sole accrediting agency.[8] To obtain federal education benefits, returning GIs had to attend an accredited school of anesthesia. Within a few years, civilian schools either brought themselves into compliance with AANA standards or quietly closed. As with certification of graduates, the AANA now found itself as the arbiter of quality in the educating of nurses as anesthetists.

THE NEW AGE AMERICAN HEALTH CARE: THE 1960s

When the 1960s began, the AANA had evolved into a more fully fledged professional organization under the influential leadership of its

first full-time executive director, Florence McQuillen, who was hired in 1948. John Lundy, the chairman of anesthesiology at the Mayo Clinic, worked with McQuillen and referred to her as "the best-read person on the literature of anesthesia." McQuillen exerted such a powerful influence at the AANA[8] that in 1965 she was named association executive of the year by the journal *Hospital Management*.

During McQuillen's tenure, membership grew considerably, exceeding 10,000 people. All 50 states had associations affiliated with the AANA. In addition, the members approved the beginnings of a continuing education program in anesthesia.[63]

The decade of the 1960s was a transitional period for everyone in health care. The United States, which had increasingly relied on employer-based health insurance since World War II, extended coverage to elderly and poor people through Medicare and Medicaid in 1965. These programs led to a greater need for health care providers. Educational programs for all health care professionals, including nurse anesthetists, expanded accordingly.

Growth was embraced by anesthesiologists in ways that were not entirely welcomed by CRNAs. Gunn recounted, "Anesthesiologists held meetings to define the future." Some sought an all-physician specialty. Others knew such a goal was unattainable because nurse anesthetists were "providing the majority of anesthesia care in the United States."[64] To resolve the manpower issue, two ideas gained prominence. Some advocated for the support of nurse anesthesia educational programs.[65] Others proposed a second anesthesia practitioner based on a physician assistant model that the anesthesiologists could control.[66,67]

The nationwide expansion of anesthesia prompted communication between anesthesiologists and CRNAs. Since 1947, an American Society of Anesthesiologists (ASA) bylaw precluded anesthesiologists from communicating with the AANA. ASA President Albert Betcher (1963) initiated efforts to establish relations with nurse anesthetists in light of the reality presented by "present and projected personnel needs."[8]

In 1964, the ASA and AANA established a liaison committee that met twice a year. McQuillen wrote that through negotiations, the AANA sought "no interference with the progress of educational programs of the Association, and a curbing of anti-nurse anesthetist activity and publicity."[68] After 3 years of meetings, the *AANA News Bulletin* and the *ASA Newsletter* published a joint statement that read in part: "It is, therefore, highly desirable that continued close liaisons be developed between these organizations for enhancing the quality and quantity of available personnel, for advancing educational opportunities, for determining ethical relationships and for the overall improvement of patient care." C.R. Stephens, a noted anesthesiologist who had worked with nurse anesthetists for many years, wrote in a 1969 report to the ASA: "Progress has not been rapid, but the dialogue has enhanced understanding."[8,69] That progress and understanding would be tested severely during the next decade.

THE 1970s

American involvement in Vietnam (Fig. 1.5) and the era of progressive reforms faded into history during the 1970s. Federal expenditures for health care rose, and in response the government exercised greater scrutiny of health services. In 1974, the US commissioner of education revised the criteria governing nationally recognized accrediting agencies, of which the AANA was one. The new criteria were intended to protect the public's interests by completely separating the professional obligations of a professional association from its proprietary concerns as a trade association.[70] The AANA, which had been widely considered the arbiter of quality in nurse anesthesia, would have to give up its roles in accrediting programs and certifying graduates, roles it had nourished and cherished since 1931. To divest itself of these operations, the AANA undertook a complete reorganization. In 1975, largely through the work of Ira Gunn, Ruth Satterfield, Mary Cavagnaro, and Ed Kaleita, autonomous councils were established and granted accrediting and certifying functions.[55]

This transition provided an opportunity for anesthesiologists to further disrupt CRNA education. Recall that anesthesiologists had turned down a similar opportunity in the 1930s. In the 1970s, the ASA proposed a "Faculty of Nurse Anesthesia Schools" that would replace the AANA as the accrediting agency. However, after strategizing and speaking before the US Office of Education, the Councils on Accreditation and Certification ultimately won the government's approval.

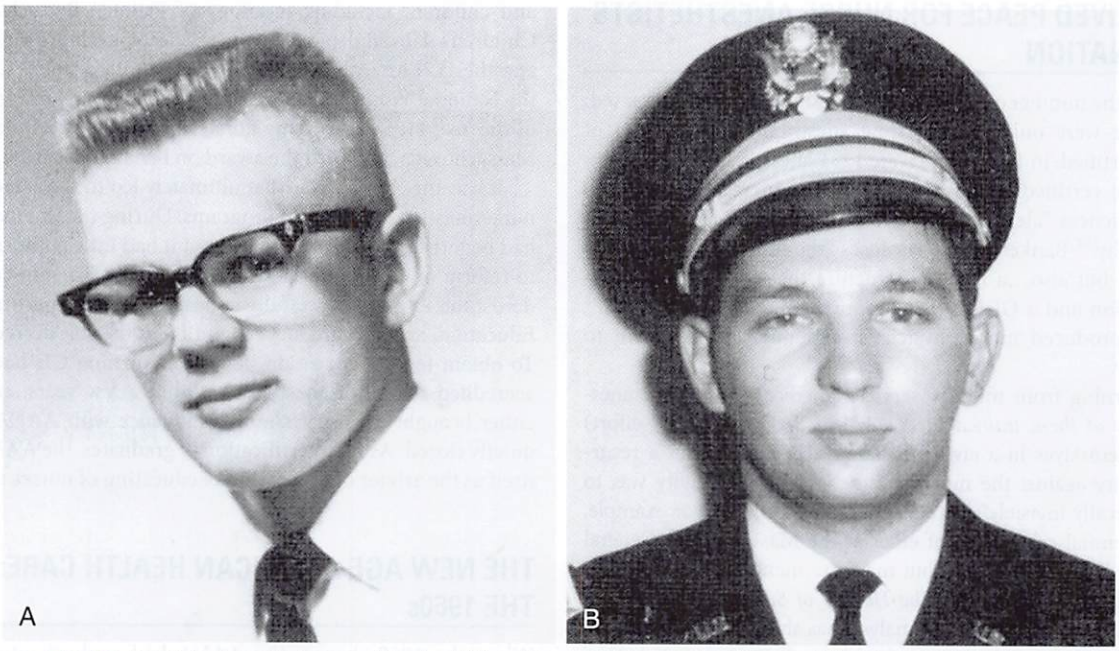


Fig. 1.5 First Lieutenants Jerome Olmsted (A) and Kenneth Shoemaker (B) were killed in 1967 following the crash of a C47 transport plane carrying wounded soldiers from Pleiku to Qui Nhon, Vietnam.

The struggle over accreditation and certification had several important outcomes. By terminating the AANA's role in accrediting schools and certifying graduates, the AANA became free to pursue laws and policies that would protect CRNAs without fear of creating a conflict between its private interests and its public duties. Second, the struggle between AANA and ASA over accreditation and certification revived the AANA's friendly relationship with the ANA, which had languished since Hodgins had first reached out to the ANA in the 1930s.[8] Third, nurse anesthetist educators saw this episode as an opportunity to upgrade educational programs and move them from hospitals into universities and colleges. John Garde, Ira Gunn, Joyce Kelly, and Sister Mary Arthur Schramm were the CRNAs who pioneered programs in the baccalaureate, and then graduate, frameworks in the early 1970s.[71] In a fourth outgrowth of this era, state nurse anesthetist organizations sought explicit legal recognition, either as a stand-alone law or within the state nurse practice act. This phase of licensure can be traced to a Department of Health, Education, and Welfare committee report from 1971 that "supported an extended scope of function for registered nurses." Higher educational standards, an increased complexity of anesthesia practice, the women's movement, and the increased presence of men in nursing have all been cited as contributing to the greater legal recognition of CRNAs.[72] Nurse anesthetists would soon be listed in the laws or regulations of all 50 states. Legal recognition provided CRNAs greater professional legitimacy. However, Mitch Tobin, the former AANA state legal affairs director, cautioned that from state to state, "the manner, type, and frequency of statutory and regulatory recognition of CRNA practice varies considerably."[73] In the following decade, the AANA would have to issue position statements to clarify and attempt to unify the ways in which CRNAs were treated under different state nurse practice acts and boards of nursing rules.

FEDERAL LEGISLATIVE INITIATIVES IN THE 1980s

By the end of the 1970s, American health care expenditures had grown from $69 billion to $230 billion, and "the reimbursement practices for hospitals and doctors were peculiarly designed to encourage higher costs.[74] Conservatives and some liberals in Congress aimed to cut that back.

Gunn described how cost control played out within anesthesia:

> *Anesthesiologists billed for services when they were not present in the hospital or even in town. Some chose not to come out at night or on weekends to supervise care provided in emergencies, yet they billed as if they had been present. A number of surgeons, and other providers, complained to both private insurers and Medicare. As a result, some private payers began limiting reimbursement to not more than two concurrent procedures, and Medicare's Inspector General focused on anesthesia reimbursement in the search for potential fraud. Around this time the AANA's Washington counsel, stated that a source in the Inspector General's office of what was then the US Department of Health, Education, and Welfare had told him that approximately 25% of Medicare fraud and abuse investigations were related to anesthesia services.*[75]

Two federal efforts to control anesthesia costs and accountability had their genesis in these unjust reimbursement practices.

TEFRA

The first federal effort to control anesthesia costs and accountability was the Tax Equity and Fiscal Responsibility Act (TEFRA), enacted in 1982. TEFRA was designed to control costs and "ensure that an anesthesiologist demonstrated that he or she provided certain services as part of a given anesthetic to qualify for payment."[76] There were seven services. An anesthesiologist would have to be present for the induction of anesthesia and remain immediately available for consultation. Anesthesiologists could no longer supervise more than four concurrent cases.

TEFRA would have some adverse implications for CRNAs. Its *Guidelines to the Ethical Practice of Anesthesiology* (adopted October 25, 1978; effective February 12, 1979) made this clear.[77] These guidelines separated reimbursement for anesthesiologists based on supervision or medical direction and specified payments on the basis of direction to be limited to not more than two concurrent procedures. Payment took two forms: Where CRNAs were employed by an anesthesiologist, each service was billed as though the anesthesiologist had administered each case. When the CRNAs were hospital employees, the time units for the anesthesiologist were cut in half. When the anesthesiologist's service was supervision and not direction (i.e., supervising three or more CRNAs), the payment was to be made under Part A of Medicare on the basis of a "reasonable charge." The hospital could still bill for the CRNA services of their own employees under Part A if the services were provided within the hospital and under Part B of Medicare if the services were provided in a surgical center.

An Existential Threat Leads to Direct Reimbursement

In early 1983, while the AANA was still dealing with TEFRA, without much fanfare and with less media exposure than usually accompanies such legislation, Congress passed a second cost control bill, the prospective payment system (PPS). The PPS revised the means of calculating Medicare billing from a cost-plus fee-for-service basis to a prospective price based on diagnosis-related groups. This measure posed a much greater threat to CRNAs than did TEFRA.

The PPS legislation was a powerful disincentive to the hiring of nurse anesthetists for the following reasons: (1) It would be impossible for the anesthesia component of payment to cover the full cost of hospital-employed CRNAs; (2) separating CRNA services from the global cost of the surgery (unbundling) was prohibited; and (3) anesthesiologists who had been billing for CRNA services under Medicare Part B could no longer do so. Taken together, these caveats meant "CRNA services were, for all practical purposes, nonreimbursable."[76]

The very real threat posed by PPS mandated action. Either the reimbursement for both anesthesiologists and CRNAs would need to be placed under the same source, Medicare Part A, or AANA would have to seek direct reimbursement rights for CRNAs under Medicare Part B.

In the 1980s, CRNAs were heavily recruited health care professionals. Most CRNAs were employed by hospitals or anesthesiologists, but a growing number of CRNAs practiced privately. Private practice CRNAs were unable to obtain reimbursement directly from Medicare, Medicaid, and many private insurance companies. After a 3-year-long effort that Bankert described as "one of the greatest lobbying achievements not only of the AANA, but of the whole of nursing," President Reagan signed into law the Omnibus Budget Reconciliation Act of 1986.[78]

Since then, Medicare and Medicaid have paid directly for all CRNA services, making nurse anesthetists the first nursing specialty to be so accorded. Of its importance, Dr. Judith Ryan, executive director of the ANA, said, "The American Association of Nurse Anesthetists' achievement to secure direct reimbursement for CRNAs is a singular, notable contribution to identification and payment of the nurse as a provider of care, and nursing services as covered health benefits."[79]

Nonlegislative Legal Problems Arise

In the same decade, events of no less significance took place in civil law pertaining to anesthesia. The courts tested whether a surgeon is liable for the actions of a nurse anesthetist. Traditionally, surgeons have

been considered "Captains of the Ship" and were therefore thought to be responsible for everything that occurred inside an operating room. Logically this theory was extended to mean that "nurses (and nurse anesthetists) become the temporary servants or agents of the attending surgeon during the course of an operation, and liability for their negligent acts may thus be imposed upon the surgeon under the doctrine of *respondeat superior*."[8] Blumenreich explained the danger to CRNAs of this theory: "When surgeons work with nurse anesthetists, the surgeons become liable for their mistakes—but when surgeons work with anesthesiologists, the surgeons do not have to worry about what happens at the head of the table." But, in fact, the theory is fallacious. Blumenreich went on to say, "First, surgeons are not always liable for the negligence of nurse anesthetists. Second, surgeons may also be liable for the negligence of anesthesiologists. Third, because a surgeon's liability, whether working with nurse anesthetists or anesthesiologists, depends on the particular facts of the situation, as a practical matter, the surgeon is likely to be included in the suit whether the surgeon is working with a nurse anesthetist or an anesthesiologist." In fact, no surgeon has been held liable in a court of law for the negligence of a nurse anesthetist. Courts have apportioned liability according to the specific facts of a case.[80,81]

A second area of civil law that affected anesthesia in the 1980s was antitrust. Nurse anesthetists, like other professionals, are subject to antitrust laws. However, they can also use those laws when they allege that others have conspired to restrict CRNA practice. Four cases involving CRNAs illustrate this point: *Bhan v. NME Hospitals, Inc.* (1985), *Oltz v. St. Peter's Community Hospital* (1988), *Hyde v. Jefferson Parish Hospital District No. 2* (1983), and *Minnesota Association of Nurse Anesthetists v. Allina Health System Corp.* (2002).

Tafford Oltz's hospital privileges were terminated when the hospital gave an exclusive contract to a group of anesthesiologists. The verdict in Oltz's favor turned on the fact that St. Peter's Community Hospital had significant enough market share within its service area to exert a monopoly, and that by awarding the exclusive contract to the anesthesiologists the hospital damaged competition.[82]

Vinod (Vinnie) Bhan sued his hospital in California after he was terminated and replaced with anesthesiologists. The defendants (both the hospital and the anesthesiologists) asserted that Bhan, as a nurse and nurse anesthetist, did not, in the eyes of the law, compete with physicians because of their different licensure. Bhan lost the case because the hospital that terminated his privileges did not have sufficient market share in the community to restrain competition. However, an appellate court ruling that gave Bhan and CRNAs standing to sue anesthesiologists as competitors set a significant legal precedent for the profession. The Ninth Circuit Court concluded: "No doubt the legal restrictions upon nurse anesthetists create a functional distinction between nurses and MD anesthesiologists. They do not, however, necessarily preclude the existence of a reasonable interchangeability of use or cross-elasticity of demand sufficient to constrain the market power of MD anesthesiologists and thereby to affect competition."[83,84] Blumenreich said, "The Bhan case was important because it gave to some extent the protections of the antitrust laws to nurse anesthetists. Hospitals could not boycott nurse anesthetists." Its results would be more "long-lasting." In a third antitrust case, *Hyde v. Jefferson Parish Hospital* (1983), an anesthesiologist sued the hospital and a group of anesthesiologists that held an exclusive contract with the hospital and worked with hospital-employed CRNAs. Dr. Hyde was denied privileges solely on the basis of the exclusive contract. Hyde claimed that a patient who was admitted for surgery in effect had no choice but to buy anesthesia from the hospital's exclusive group of anesthesiologists. The Jefferson Parish Hospital District won the case at the lower court level, but Hyde appealed all the way to the US Supreme Court.

The ASA filed an *amicus curiae* brief, but in support of Dr. Hyde. The ASA opposed exclusive contracts but attempted to link its opinion to the quality of care, stating that "the elimination of competition through a classic tying arrangement is not simply a matter of dollars and cents. It can adversely affect the quality of medical care. ASA believes that in this setting, it is particularly important that competition be allowed to reward superior performance and innovation, while exposing the indifference to quality that may too often be the hallmark of a monopoly."[85]

The Supreme Court ruled unanimously in favor of the hospital's right to award an exclusive contract for anesthesia services. A footnote in the Court's opinion to the effect that 'there has been no showing that nurse anesthetists provide a lesser quality of care' led Blumenreich to conclude that the AANA accomplished what it set out to do.[86] Gunn wrote that "the Hyde case alerted the AANA to the need to revitalize its public relations program, continue its watch for attempts to discredit CRNAs, and take action either to correct or to prevent further damage."

In a fourth and final antitrust-related case, the Minnesota Association of Nurse Anesthetists (MANA) sued a hospital group and its anesthesiologists alleging restriction of trade and fraudulent billing. Anesthesiologists had forced CRNAs to leave their jobs and return only under restrictive and lesser paying conditions, while at the same time they billed for supervising CRNAs without fulfilling the necessary steps outlined earlier under TEFRA and the PPS conditions for payment. CRNAs across the country donated at least $2.5 million to support the prosecution. The antitrust case was ultimately dismissed, but the fraudulent billing portion resulted in a $10 million out-of-court settlement in favor of MANA. With the settlement money MANA repaid a loan from the AANA and made a significant contribution to the AANA Foundation. Brian Thorson, president of MANA and then-president of AANA during the 10-year-long case, said CRNAs who contemplate using the antitrust laws to right a wrong should think twice:

> *Never be afraid to stand up to injustice. With that in mind, the opposition will be extremely well funded, and it is difficult to topple organized medicine.*
>
> ***Brian Thorson, AANA President***

CRNA ACHIEVEMENTS OF THE 1980s

Although much attention focused on events taking place on the legal front, other important areas of practice were advanced in the 1980s. For example, liability insurance coverage, first offered to CRNAs in 1974 by outside brokerages, was skillfully brought in-house when the AANA bought the Glen Nyhan Agency. Renamed A+, and now called AANA Insurance, the agency has provided a steady stream of insurance to CRNAs since 1988, without which CRNAs would be subject to outside insurance companies, some controlled by physicians.

The AANA Education and Research Foundation was established in 1981; it would be renamed the AANA Foundation in 1995. The foundation has enjoyed enormous support. A current report lists scholarships, grants, poster presentations, fellowships, and health policy research in excess of $4.2 million given to 3800 individuals.[87,88]

The history of nurse anesthesia would be incomplete without remembering CRNA Goldie Brangman (Fig. 1.6). In September 1958 at Harlem Hospital in New York City, Brangman was called to take over at the head of an operating room table by her mentor Helen Mayer, an anesthesiologist. Brangman recalled, "Dr. Mayer stood up, and I sat down." The patient was Dr. Martin Luther King Jr., who had been stabbed while autographing copies of his first book, *March to Freedom*. King would live another 10 years and change history. Brangman, who lived to the age of 102, went on to change anesthesia. She completed 45 years at

Fig. 1.6 Goldie Brangman.

the Harlem Hospital, 38 of them as director of its school of nurse anesthesia, educating at "least 700 to 750 students. There weren't too many schools at the time that admitted blacks, men, or students from foreign countries. We would hold dinners each weekend and try different foods representing one of our students' diverse ethnic backgrounds."[89]

Between 1967 and 1973, Brangman ascended the AANA hierarchy. As president in 1974, Brangman devoted herself to improving the internal workings of the AANA, which had languished following the 1970 retirement of McQuillen. Her leadership brought on modernized internal and external communications and business methods, and it established an executive committee of the board of trustees. At the same time, the AANA annual meeting was (1) expanded to include concomitant lectures, refresher courses, special activities, and lectures for students and (2) streamlined with written, rather than verbal, committee reports and other important information. Under Brangman's leadership, the members voted to discontinue holding the AANA annual meeting in conjunction with the American Hospital Association. These steps were evidence of dramatic advances in corporate financial and professional maturity.

Brangman was principally an educator who extended the possibility of nurse anesthesia to many who, because of their race, might not otherwise have been admitted to a program. Moreover, she taught regional anesthesia long before it became a standard part of the curriculum and pioneered quality assurance in anesthesia. Brangman was honored with both the Helen Lamb Outstanding Educator Award and Agatha Hodgins Award for Outstanding Accomplishment, the profession's highest attainments. Years later, near the end of her impactful life, Brangman inspired other CRNAs of color to initiate a diversity and inclusion program that would further correct the racial imbalance in nurse anesthesia.[90,91] Marianne Downey (nee Bankert) (Fig 1.7) was an English professor who wrote the vital publication, "Watchful Care: A History of America's Nurse Anesthetists." She had been chair of the English department at the College of Joliet (Illinois) where she took a keen interest in the history of nurses, and nurse anesthetists in particular. Hired by the AANA to follow up the earlier work of Thatcher, Downey showed through astute analysis that early and later CRNAs fought gender-based and economic discrimination to build a nursing specialty that is second to none. "Watchful Care," published in 1989, received very positive reviews from, among other journals, the *American Association for the History of Nursing*,[92] the *Bulletin of the History of Medicine*,[93] and *The Journal of American History*.[94] That Downey conducted her research before the AANA established its own archival program, when 50+ years of books and inactive records were stacked in cardboard boxes in the dusty attic above the association's offices, makes her accomplishment that much more laudable.

Fig. 1.7 Marianne Downey (nee Bankert).

In addition, Downey prompted the AANA to preserve its own history by establishing a formal archival program, which lives on today as the John F. Garde Archives.

THE CALL FOR HEALTH CARE REFORM IN THE 1990s

Bill Clinton (whose mother, Virginia Kelly, was a CRNA)[95] was elected president in 1992 with a promise to reform health care. For a variety of reasons, Clinton's health care plan was defeated. In its place, the health insurance industry, in conjunction with the major businesses that provided health insurance to their employees, forced a form of "managed care" on a large portion of the insured population. Managed care, in theory, was intended to (1) move the health care system from a disease treatment to a health maintenance system; (2) do away with incentives found in the fee-for-service system—that is, the more services provided, the more money made—and thereby reduce unnecessary health services[96,97]; (3) promote a cost-effective workforce by emphasizing primary care providers and nonphysician professionals; and (4) promote a shift from independent practice patterns to greater use of salaried personnel. Some anesthesiologist groups found that, under managed care, their workload declined by 40%.[98] Physicians thus scrambled to protect autonomy and income, while patients sought to preserve some choice of provider.

When CRNAs won direct reimbursement rights in 1986, they agreed to accept no more than the amount Medicare assigned for the service as payment in full. In other words, CRNAs would not "balance bill" patients for any portion of their fees. Payment schedules were then devised for anesthesiologists working alone, CRNAs working alone, and anesthesiologists medically directing CRNAs in team practice settings. In the early 1990s, a Government Accounting Office (GAO) study[99] revealed that payments for anesthesia services under the medical direction arrangement were 120% to 140% greater than payments for CRNAs or anesthesiologists working alone. This payment scheme served as a strong incentive for anesthesiologists to employ CRNAs, but it was not budget neutral, which had been the intent of Congress. The GAO recommended payment of only one anesthesia fee, totaling no more than if an anesthesiologist performed the service alone. Furthermore, the study recommended that payment for anesthetic procedures under the medical direction model be split 50% for the

CRNA service and 50% for the anesthesiologist service, a significantly reduced portion for both the anesthesiologists and the CRNAs. The AANA chose to support the single-payment plan. The ASA opposed it. The single-payment reimbursement plan was implemented, and tension between the two groups was exacerbated again.

The reforms of the 1990s, together with the new ability to bill third-party payers for their services, led entrepreneurial CRNAs to venture into the business of anesthesia. At the same time, the Jack Neary Pain Fellowship brought the subspecialty of pain control within the reach of CRNAs. Private CRNA practice had been largely limited to office-based surgery centers and small rural hospitals. Now corporate practices catering to hospitals and larger surgery centers grew, including pain practices. In this scenario, a CRNA businessperson might perform cases but would facilitate and manage a contract for one or more clinical sites.

Attempts to Measure Quality of Care

It was mentioned earlier that during the second half of the 20th century, physicians and then nurses attempted to evaluate the quality of anesthesia care by measuring death rates. In the aforementioned Beecher and Todd study, the anesthesiologist outcomes were inferior to CRNA outcomes.[100] Two decades later, amid complaints about the Veterans Administration (VA) health care system, the US House of Representatives mandated a study by the National Science Foundation regarding the care given to veterans. At the time, CRNAs provided much of the anesthesia administered at VA facilities. The reviewers reported back to Congress in 1977 that there were no significant differences in anesthesia outcomes based on the providers of that care.[101]

In 1980, an anesthesiologist named W. H. Forrest published a portion of an institutional differences study conducted by the Stanford Center for Health Care Research. Forrest divided the institutions between those predominantly served by nurse anesthetists and those predominantly served by anesthesiologists. He concluded—using conservative statistical methods—that there were no significant differences in anesthesia outcomes between the two anesthesia providers.[102]

A North Carolina retrospective study of anesthesia-related mortality from 1969 to 1976, which was performed by a committee from the North Carolina Society of Anesthesiologists, was published in 1981. The findings were similar for all providers (e.g., CRNAs working alone, anesthesiologists working alone, and CRNAs and anesthesiologists working together as a team); however, no test of significance was made in this study.[103]

Between 1992 and 2003, additional studies by Abenstein and Warner, Silber et al., Wiklund and Rosenbaum, and Vila et al. were published and promoted as evidence that "the utilization of anesthesiologists improves anesthesia outcomes." These studies and their rebuttals were summarized in "Quality of Care in Anesthesia," a 2009 publication by AANA.[104] The article by Abenstein and Warner "purported to analyze the quality of care…but failed to mention the key conclusion." For example, the authors claimed that there were "differences in the outcomes of care based on type of provider, *notwithstanding that the actual researchers came to the opposite conclusion*" (emphasis original). The Silbur study "examined the death rate, adverse occurrence rate, and failure rate of 5972 Medicare patients." One analyst concluded that these data were, in fact, not "specific to anesthesia staffing," and "the type of anesthesia provider does not appear to be a significant factor in the occurrence of potentially lethal complications." Two studies attributed to Wiklund and Rosenbaum were also found to be irrelevant. The AANA reviewer pointed out that Wiklund and Rosenbaum, by attributing safer anesthesia to a federal decision to "support training in clinical anesthesiology" had left "the path of unbiased review of the specialty to make unsubstantiated or misleading comments about the unilateral contributions of anesthesiologists to the advancements achieved."

The Silber study stirred up "serious questions of objectivity." "Reportedly, both the *Journal of the American Medical Association* and the *New England Journal of Medicine* declined to publish" it. The timing of its publication led to questions about its motivation. "The abstract was published in the midst of the controversy over the Health Care Financing Administrations (HCFA's) proposal to remove the physician supervision requirement for nurse anesthetists in Medicare cases." The AANA reviewers concluded, "The timing of the publication in the ASA's own journal was politically motivated" to influence the HCFA (now known as the Centers for Medicare and Medicaid Services [CMS]). However, CMS ultimately "dismissed all claims" made by the authors in this study.

The Vila study compared outcomes at ambulatory surgery centers (ASCs) with those in office operating rooms (a practice for many independent CRNAs). It claimed that "the risk of adverse incidents and deaths was approximately 10 times greater in the office setting than in an ASC, and that if all office procedures had been performed in ASCs, approximately 43 injuries and six deaths per year could have been prevented." It concluded with the hopeful remark that "the presence of anesthesiologists in ASCs may be a factor in more favorable outcomes." The AANA analyst pointed out flaws in both the methodology and conclusions of this study. The study "does not specifically mention CRNAs," yet it "makes the unsupportable assertion that office surgery may not be as safe when an anesthesiologist is not present."

Misuse of outcomes research was extensive during this era. Gunn wrote that "in the medical literature in the 1990s, serious questions were raised regarding the quality and relevance of published research, the peer review system, and the selection of articles for publication."[105] A 1993 review concluded that 95% of the medical research being published in journals was either flawed or irrelevant.[106]

The Federal Supervision Regulation

In what past-President Larry Hornsby described as a "message from the grave," Magaw commented that, during the 1890s at the Mayo Clinic, physicians oversaw nurse anesthesia in a "general way." In other words, Magaw and her colleague Henderson were on their own. In the next 20 years, as the acceptance of nurse anesthetists grew, a few physicians sought control over the women who practiced anesthesia. The 1915 challenge to the Lakeside Hospital School made this trend clear. Nurse anesthetists welcomed the legislation sought by Crile and some of his colleagues in Ohio that for the first time codified the practice of nurse anesthesia in law.[11] As noted earlier, the legislation mentioned supervision, but it legitimized their practice.[37,107]

In the 1980s, at the same time TEFRA took effect, the number of anesthesiologists tripled. Increased competition in the anesthesia marketplace prompted Blumenreich to write that supervision became the springboard for yet new attacks. In 1985, H. Ketcham Morrell, president of the ASA, wrote: "…the operating surgeon or obstetrician who purports to provide medical direction of the nurse, in the absence of an anesthesiologist, carries a high risk of exposure, on a variety of legal theories, for the acts of the nurse."[108] An unknown number of surgeons opted for anesthesiologists as a result. Imagined liability among surgeons became such a crisis that Blumenreich wrote: "…no subject has received more of my attention."

For CRNAs, removing supervision from the Medicare Rules was an obvious remedy, because it would impact practice in every

state. From 1994 to 2001, HCFA and AANA attempted to do just that. The enormous struggles that ensued were chronicled briefly by Patrick Downey in the *AANA Journal*[109] and in captivating detail by Sandra Larson.[110] Legislation was introduced in both houses of Congress that would remove the supervision requirement and address reimbursement issues. Both the AANA and ASA responded with grassroots public relations campaigns, and the legislation went nowhere. Then, in December 1997, HCFA proposed a major change in its *Hospital Conditions of Participation*, including the elimination of physician supervision of CRNAs. Nursing organizations lined up in support of the change, but medical opposition was fierce. Nullifying legislation was proposed, as were safety studies to delay its consideration. More public relations were deployed, and the controversial claims of the Silbur study (that outcomes are better when CRNAs are supervised by anesthesiologists) were invoked. In March 2000, HCFA ruled that CRNAs could practice without physician supervision, and in its ruling HCFA deemed the Silbur study "irrelevant." But the new rule was not implemented until the final days of the Clinton administration, and the Bush administration, as all new administrations do, placed a moratorium on late-term regulations. In November 2001, the Bush administration, in response to vigorous and costly lobbying by the ASA, "allowed political favoritism" to prevail over rigorous policymaking. The new administration restored the earlier rule containing supervision.

The "final" rule contained an escape clause, a proviso allowing state governors to opt out. Between 20 and 31 states had no laws specifying supervision of CRNAs, which meant governors, if inclined, might provide an opt-out. Before long, some governors did. Iowa was the first, and then a number of rural western states opted out. To date, governors in 19 states have done so. These include Iowa, Nebraska, Idaho, Minnesota, Arizona, New Hampshire, New Mexico, Kansas, North Dakota, Washington, Alaska, Oregon, Montana, South Dakota, Wisconsin, California, Colorado, Kentucky, and Oklahoma. In Michigan, to meet the expanded need for providers during the Covid-19 pandemic, Governor Whitmer suspended the supervision requirement "until the end of the declared emergency." It is unclear what she will do if and when the Covid-19 emergency ends.[111] Depending on one's interpretation of the eligibility rules, this includes between 60% and 90% of eligible states.

Opting out of physician supervision has not altered the safety of anesthesia. Two prominent health economists, Brian Dulisse and Jerry Cromwell, studied Medicare data between 1999 and 2005.[112] They found "no evidence that opting out of the oversight requirement resulted in increased inpatient deaths or complications." This came as no surprise to the AANA and CRNAs. The authors concluded: "We recommend that CMS return to its original intention of allowing nurse anesthetists to work independently of surgeons or anesthesiologist supervision without requiring state governments to formally petition for an exemption."

Other contemporary studies supporting this assertion were collected in the publication *Quality of Care in Anesthesia*.[113] They reported no significant differences between CRNAs and Anesthesiologists with respect to obstetric anesthesia outcomes, similar mortality rates when working individually, and no difference for team versus solo practice. There was also no differences in mortality in hospitals without an Anesthesiologists versus those where they provided or directed anesthesia care. Lastly, the Institute of Medicine—the health arm of the National Academy of Sciences—weighed in with a report, entitled "The Future of Nursing: Focus on Scope of Practice."[114] The report came as a powerful endorsement of nurses as high-quality clinicians. Its conclusion reads, in part:

> *It is time to eliminate the outdated regulations and organizational and cultural barriers that limit the ability of nurses to practice to the full extent of their education, training, and competence. The U.S. is transforming its health care system to provide quality care leading to improved health outcomes, and nurses can and should play a significant role. The current conflicts between various APRNs scope of practice are based on their education and training. State and federal regulations must be resolved so that they are better able to provide seamless, affordable, and quality care. Scope-of-practice regulations in all states should reflect the full extent not only of nurses but of each profession's education and training. Elimination of barriers for all professions with a focus on collaborative teamwork will maximize and improve care throughout the health care system.*

DOCTORAL PREPARATION OF NURSE ANESTHETISTS ACHIEVED

Upgrading Nurse Anesthesia Educational Requirements

Improving academic credentials for CRNA educators and their graduates has always been closely aligned with the goals of the professional association.[115] Nurse anesthesia educators have been responsible for increasing requirements for curricular content, faculty qualifications, and academic credentials for graduates since the early 20th century. Over time, schools of anesthesia have changed from apprenticeships at hospitals into degree-granting institutions fulfilling the vision of early anesthesia leaders for a university education for nurse anesthetists. This movement into academia required identifying the location of schools of anesthesia throughout the nation, determining the essential characteristics of better schools, agreeing on curricular requirements, inspecting schools, and developing a school approval process. Lamb envisioned the bright professional future this upward trend might bring about, writing in 1936 that schools of anesthesia should seek affiliation with universities, and that such affiliation "should eventually result in broadened facilities, both practical and cultural."

Beginning in the mid-1980s, the AANA and the Council on Accreditation (COA) assessed the need for and feasibility of practice-oriented doctoral degrees for nurse anesthetists. In June 2005, the AANA board of directors convened an invitational summit meeting to discuss interests and concerns surrounding doctoral preparation for nurse anesthetists. Following the summit, a Task Force on Doctoral Preparation of Nurse Anesthetists (DTF) was formed and charged with developing options related to doctoral preparation of nurse anesthetists for the AANA board to consider.[116] The DTF's final report and options were presented to the AANA board of directors in April 2007, and in June 2007 the board unanimously adopted the position of supporting doctoral education for entry into nurse anesthesia practice by the year 2025.

Setting a requirement for doctoral education followed in October 2009, when the Council on Accreditation of Nurse Anesthesia Education Programs adopted this position: "The COA will not consider any new master's degree programs for accreditation beyond 2015: and that students accepted into an accredited program on January 1, 2022, and thereafter must graduate with doctoral degrees." The position became part of the Standard on Accreditation of Nurse Anesthesia Educational Programs and the basis for drafting new standards for clinical doctorate programs.[116]

The Changing Face of Nurse Anesthesia

In 2007, President Terry Wicks realized the low visibility of minority CRNAs.[117] AANA had admitted its first black members in 1944,

but there had been just one black AANA president, the late Goldie Brangman. Brangman, when she was AANA treasurer, had been excluded from speaking at board meetings; the overall percentage of black CRNAs remained well below 10%, and the number who ascended to state and national positions could be counted on one hand. Wallena Gould and Regina Daniels McKinney developed and implemented a wide-ranging diversity and inclusion effort, including mentorship of candidates and support for students and faculty. Brangman commented that the diversification was a pleasure for her to behold, adding that it builds a better AANA.

MILITARY ANESTHESIA

The US military remains engaged around the world. CRNAs deploy to trouble spots as members of the armed forces. Others work within the Department of Health and Human Services for the US Public Health Service and the VA. CRNAs are versatile, fulfilling more than clinical duties in today's military; they are also leaders and, in some cases, soldiers on the line. CRNAs Maj. Steve McColley and Cpt. Mitchell Bailey earned Bronze Star Medal nominations for acts of courage in Iraq. Maj. Jeffrey Roos, a CRNA stationed at Fort Benning, Georgia, earned a Bronze Star from the army for his lifesaving efforts during Operation Anaconda, the first major US offensive launched in Afghanistan after the September 11, 2001, attacks on the World Trade Center. A CRNA was in the news for extricating Pvt. Jessica Lynch from a hospital in Iraq.

In past wars, CRNA deployments reduced anesthesia staff at stateside hospitals. No data exist to describe the overall impact of the latest escalation on anesthesia services in stateside hospitals. However, the impact of deployments has been mitigated somewhat following a recent policy change in the navy. Navy CRNAs are now considered "licensed independent practitioners" (LIPs), a term coined by The Joint Commission (TJC). According to Cpt. Annette Hasselbeck, NC USN, LIP status has enabled the navy's medical planners to use global sourcing of CRNAs. CRNAs are used interchangeably with anesthesiologists, based on skills, seniority, and availability. This had always been the pattern in practice, but defining CRNAs as LIPs has kept practice in compliance with TJC policy. According to Cpt. Ron Van Nest, NC USN (retired), the policy was changed in 2000 to reflect the fact that CRNAs very often deploy alone and capably make independent clinical decisions that affect anesthetic management. Recognizing CRNAs as LIPs has also kept morale high; all billets are filled, and retention of naval CRNAs is at 100% as of this writing.

INTERNATIONAL FEDERATION OF NURSE ANESTHETISTS

The International Federation of Nurse Anesthetists (IFNA) is a coalition of national associations of nurse anesthetists. It is an affiliate member of the International Council of Nurses and a Nursing Partner of the World Health Organization. The IFNA represents more than 50,000 nurse anesthetists worldwide and is a growing organization with members in both developed and developing countries. The first organizational meeting was held in September 1988, and 11 countries were admitted as charter members in 1989. A World Congress is held every 2 years and is hosted by a member country.

To date, there are 36 member countries. The IFNA has developed international standards for education, standards of practice, standards for patient monitoring, and a code of ethics for nurse anesthetists.[36] An anesthesia approval process for entry-level programs was launched in 2010, offering three levels of awards: registration, recognition, and accreditation. The goal of the Anesthesia Program Approval Process is to encourage programs to comply with the IFNA's *Educational Standards for Preparing Nurse Anesthetists* through an approval process that takes cultural, national, or regional differences into consideration.[118]

PROGRESS IN ANESTHESIA

Since the 1890s, nurse anesthetists facilitated the advancement of modern surgery. Their expertise with ether anesthesia made possible the first successful intracranial, thoracic, adult and pediatric cardiac, and trauma operations.[108] Nurse anesthetists elevated the quality of anesthesia education available to nurses by implementing certification and recently recertification by examination, accreditation of schools, mandatory continuing education, and progressively higher degree standards for entry into practice. Progress in nurse anesthesia attributable to CRNAs has occurred in other areas as well. The AANA Foundation describes hundreds of recent and ongoing CRNA-led research projects.[119] These projects range from basic and applied sciences to clinical anesthesia, education, and economics. Public awareness of CRNAs grew in 2020 as a result of Covid-19. CRNAs are at the forefront of the battle against Covid-19 and frequently appeared in the media during the initial outbreak. This was a marked change from decades in which they were aptly described as "the best kept secret in health care." Notable articles and photographs are listed at "CRNAs in the News."[120]

SUMMARY

Nurses were recruited into the field of anesthesia by surgeons in the latter half of the 19th century because inexpert clinical anesthesia administration by others often resulted in morbidity and mortality. The Civil War was the earliest documented use of nurses as anesthetists, and it became a trend thereafter. By the 1890s, nurse anesthesia, having spread from midwestern Catholic hospitals to cities on both coasts, made anesthesia increasingly safe and thereby facilitated the advancement of surgery. Before the turn of the 20th century, nurse anesthetists provided gratuitous training to others. They opened the first hospital-based anesthesia educational program in 1909. During World War I, nurse anesthetists significantly reduced combat-related surgical morbidity and mortality. By 1920, nurse anesthesia had become well established and well accepted.

Nurse anesthetists formed a national organization in 1931. Dedicating themselves to advancing anesthesia education and patient safety, nurse anesthetists implemented a number of firsts: annual meetings, a monthly bulletin, and a journal. In 1945, the first certification examination for graduates was implemented. As a result of service in the midcentury wars, nurse anesthetists earned officer's status, and men gained the right to join the military's nurse corps. When the military demanded that its nurse anesthetists pass the AANA certification examination, civilian hospitals soon followed suit. By the 1950s, nurse anesthetists worked with surgeons and engineers to pioneer anesthesia machinery, ventilators, and anesthesia for pediatric cardiovascular surgery. During this era, accreditation of anesthesia training programs was achieved.

The second half of the 20th century was marked by a closer involvement between the profession and government. As Medicare paid for a larger proportion of clinical anesthesia services, the government in turn exerted increasing control over how those services were rendered and at what cost to taxpayers. Federal dollars were allocated for nursing education, and the government exerted a measure of control over accreditation. Independent counsels on accreditation, certification, recertification, and public interest evolved.

In the 1960s and 1970s, state governments modernized nurse practice acts to account for new subspecialties in advanced practice nursing. CRNAs had to participate, even though they had long predated other advanced practice nurses. The 1980s and 1990s brought about governmental efforts to "reform" health care by extending services and containing costs. Quality of care entered the debate, and CRNAs ultimately proved what had been shown 50 years earlier: Anesthesia outcomes are no worse and perhaps better when a CRNA administers the anesthetic. For CRNAs, constant vigilance and a presence in federal and state government centers were essential because of each of the aforementioned policy changes.

Progress in nurse anesthesia has occurred over many decades and resulted in an extraordinary record of patient safety. CRNAs have undertaken hundreds of clinical, scientific, and policy research projects to further professional and public understanding of nurse anesthesia.

Patient	Intervention	Comparison	Outcome
61-year-old male, infarction	Streptokinase	Plasminogen activator	Death
31-year-old female, laparoscopy	Ondansetron 4 mg	Droperidol 1.25 mg	Nausea
17-year-old male, arthroscopy	Spinal anesthesia	—	Time in PACU

REFERENCES

For a complete list of references for this chapter, scan this QR code with any smartphone code reader app, or visit the following URL: http://booksite.elsevier.com/9780323711944/.

2

Nurse Anesthesia Specialty Practice and Education in the United States

Francis Gerbasi, Lynn Reede

NURSE ANESTHESIA EDUCATIONAL REQUIREMENTS

Nurse anesthesia educational requirements form the foundation for the nurse anesthesia profession. The upgrading stringent and robust educational requirements ensure that graduates have the knowledge, skills, and abilities to enter into practice and provide safe anesthesia care. In 1931 the National Association of Nurse Anesthetists (NANA) was established by Agatha Hodgins. A primary goal of NANA was to develop nurse anesthesia educational objectives.[1] In 1939 the NANA changed its name to the American Association of Nurse Anesthesia (AANA). Accreditation standards and processes were established to ensure high-quality nurse anesthesia programs. The accreditation function for nurse anesthesia programs was performed by the AANA until 1975 when the Council on Accreditation of Nurse Anesthesia Educational Programs (COA) was established and assumed responsibility for establishing the standards and accreditation of nurse anesthesia programs. The COA is the only accrediting agency recognized by the US Department of Education (USDE) and the Council for Higher Education Accreditation (CHEA) to accredit nurse anesthesia programs in the United States and Puerto Rico. The scope of the COA's accreditation includes nurse anesthesia programs that award post-master's certificates, master's, or doctoral degrees, including programs offering distance education. The standards (i.e., master's, doctoral, and fellowships) are measures used by the COA to assess the quality of nurse anesthesia education. The COA has been responsible for increasing the requirements for curricular content, faculty qualifications, and academic credentials for graduates. This includes the requirement that all COA-accredited nurse anesthesia programs award a master's degree in 1998 and award doctoral degrees to students entering programs on January 1, 2022, and thereafter.

Nurse Anesthesia Education Today

As of January 1, 2021, there are 124 accredited nurse anesthesia programs and 5 new programs in capability review. There are 103 nurse anesthesia programs approved to offer entry-level doctoral degrees and 25 programs offering post-master's doctoral completion degree programs for Certified Registered Nurse Anesthetists (CRNAs). The remaining 21 programs must be approved by the COA to award doctoral degrees for entry into practice by the deadline of January 1, 2022. The progress made in programs transitioning to award doctoral degrees in the last 10 years is shown in Fig. 2.1.

Nurse anesthesia programs are currently governed by two sets of standards based on the degree the program is awarding. Programs awarding master's degrees are governed by the 2004 *Standards for Accreditation of Nurse Anesthesia Educational Programs*.[2] Programs awarding doctoral degrees are governed by the Standards for Nurse Anesthesia Programs: Practice Doctorate.[3] In 2014 the COA established Standards for Accreditation of Post-Graduate CRNA Fellowships.[4] The processes used to accredit programs and fellowships are focused on ensuring compliance with the *Standards* and the COA *Accreditation Policies and Procedures*.[5]

Accreditation provides a means to assure and improve higher education quality.[6] Revisions to the *Standards* and the accreditation policies occur periodically in order to ensure they continue to reflect the current requirements and prepare graduates for entry into practice, meet USDE and CHEA recognition requirements, and promote improvement in nurse anesthesia education. In 2011, the COA initiated a major revision of its Standards with the purpose of establishing new practice doctorate standards. In 2015 the COA approved the practice doctorate standards.[7] In 2016 the COA established the Programs' Transitions to the Doctoral Level policy.[5] The policy provides the procedural information for programs and reinforces the requirements that all accredited programs must offer a doctoral degree for students entering nurse anesthesia programs by January 1, 2022, and thereafter.

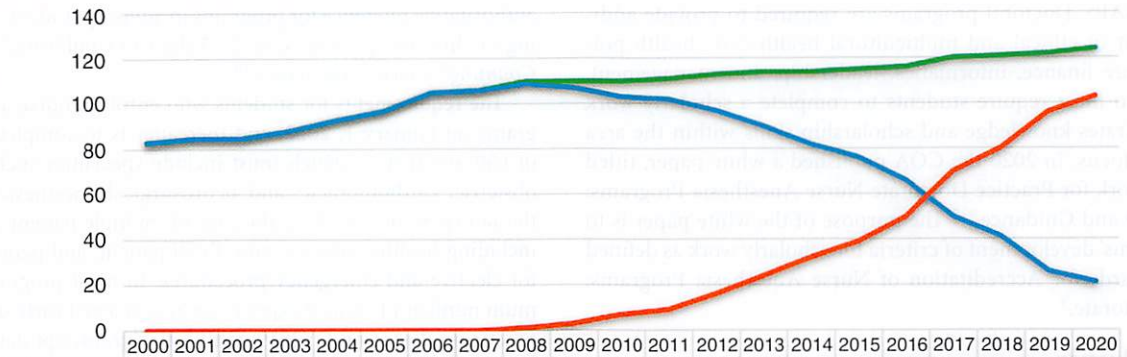
General Educational Requirements for Nurse Anesthesia Programs

Nurse anesthesia programs are required to demonstrate compliance with the *Standards* and the *Accreditation Policies and Procedures* to be accredited by the COA. Programs are required to assess their integrity and educational effectiveness through ongoing evaluation and assessment. Programs must continually monitor and evaluate their didactic and clinical curriculum, including but not limited to curricular content, admissions policies, faculty, and clinical sites used for student educational experiences. In addition to programs' internal assessment processes, programs must submit annual reports to the COA, complete self-studies, and host onsite COA visits.

National Certification Exam Pass Rate

The COA monitors programs' indicators of success and the attainment of their stated outcomes. This includes each program's pass rates on the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA) National Certification Examination (NCE), students' attrition, and graduates' employment rates.

Programs must demonstrate graduates take the NCE examination and pass it in accordance with the COA's pass-rate requirement. The COA established a certification exam policy for monitoring programs' NCE pass rates in 2003. Major revisions to the policy were made in 2006, 2013, 2016, and 2019. The most recent revised policy establishes three methods that programs can use to meet the mandatory requirement of 80%.[5] Programs must meet or exceed the COA mandatory pass rate using one of the three methods. Programs that fall below the mandatory pass rate will be monitored and must demonstrate improvement. If improvement is not demonstrated within the established



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	83	85	85	88	93	97	105	106	110	110	110	111	113	114	114	115	116	120	121	122	124
Masters	83	85	85	88	93	97	105	106	109	107	103	102	97	90	82	76	66	50	41	26	21
Doctoral	0	0	0	0	0	0	0	0	1	3	7	9	16	24	32	39	50	70	80	96	103

Fig. 2.1 Progression of nurse anesthesia programs transitioning to award doctoral degrees.

timeframe, then that specific programs' accreditation is subject to an adverse accreditation action.[8]

In addition, the COA's Public Disclosure of Accreditation Decisions and Performance Data policy requires programs to accurately post their first-time NCE pass rates, attrition rates, and employment rates graduates on their websites, and to link their websites to the COA's list of Accredited Programs.[5,9] These stringent requirements help ensure the effectiveness of nurse anesthesia clinical and didactic education, as well as ensuring that the public is being provided with accurate information related to student achievement.

To assess the overall quality of nurse anesthesia programs, the COA conducts periodic assessment of recent graduates' preparedness for entry into practice. The most recent assessment was conducted in 2015. The results were similar to the previous survey conducted in 2011 that indicated 98% of graduates and 97% of employers identified graduates were prepared for entry into practice. Ninety-six percent of the employers indicated they would hire the same graduates again.[10]

Requirements for an Increase in Class Size

High-quality educational programs must have sufficient resources. In 2013 the COA approved a Program Resources and Student Capacity policy.[5,11] The policy requires programs to submit a request to increase their COA-identified class size verifying there are adequate resources to support the size and scope of the offering to appropriately prepare students for practice and to promote the quality of graduates. Requests to increase class size must be approved prior to the enrollment of additional students.

Nurse Anesthesia Program Administration

The COA has requirements related to the administration of nurse anesthesia programs. The requirements include programs' management of faculty and students, fiscal management, maintenance of COA accreditation and other higher education accreditation requirements of the universities, faculty continuing education, and program evaluations. In 2009 the COA approved a position statement requiring nurse anesthesia programs to employ CRNAs with doctoral degrees in the roles of program administrator and assistant program administrator by January 1, 2018. This was done to support programmatic transition to the doctoral degree for entry in to practice.[12]

Nurse Anesthesia Program Admission Requirements

Programs are required to enroll only students who are of quality appropriate for the profession, and who have the ability to benefit from their education. Minimum admission requirements include graduation from a school of nursing, a baccalaureate or graduate degree in nursing or an appropriate major, current unencumbered license as a registered nurse (RN), and a minimum of 1 year of full-time work experience as a registered nurse in a critical care setting. However, the average critical care experience of RNs entering nurse anesthesia programs is 2.9 years.[13] The critical care experience must have provided the RN with the opportunity to develop as an independent decision maker capable of using and interpreting advanced monitoring techniques based on knowledge of physiologic and pharmacologic principles. Programs determine what types of work experience are acceptable for admission to meet this requirement. Examples of critical care areas include but are not limited to surgical, cardiothoracic, coronary, medical, pediatric, and neonatal intensive care units.

Nurse Anesthesia Education Program Curriculum

Didactic Education

The didactic curricula of nurse anesthesia programs are governed by the master's and doctoral *Standards* and help ensure students are provided with the scientific, clinical, and professional foundations upon which to build sound and safe clinical practice. Programs must demonstrate they provide an extensive educationally sound curriculum combining both academic theory and clinical practice. The curricula must include three separate courses in advanced physiology/pathophysiology, advanced pharmacology, and advanced health assessment. This requirement is consistent with the educational requirements identified in the Advanced Practice Registered Nurse (APRN) Consensus Model.[14] The curricula must also include content areas such as human anatomy, chemistry, biochemistry, physics, genetics, acute and chronic pain management, professional role development, anesthesia equipment, technology, research, clinical correlation conferences, radiology, ultrasound, wellness and substance use disorder, and business of anesthesia/practice management (refer to 2004 Standards, Standard III, Criterion C14 and Practice Doctorate Standards, Curriculum Standards, E.2).[2,3] Courses ensure graduates have the knowledge to provide safe, high-quality anesthesia care. Course content includes the induction, maintenance, and emergence from anesthesia; airway management; anesthesia pharmacology; and anesthesia for special patient populations such as obstetrics, geriatrics, and pediatrics.

Practice Doctorate Scholarly Work

Programs awarding doctoral degrees most commonly award either a Doctor of Nursing Practice (DNP) or Doctor of Nurse Anesthesia

Practice (DNAP). Doctoral programs are required to provide additional content in ethical and multicultural health care, health policy, health care finance, informatics, leadership, and management. Programs also must require students to complete a scholarly work that demonstrates knowledge and scholarship skills within the area of academic focus. In 2020 the COA published a white paper, titled "Scholarly Work for Practice Doctorate Nurse Anesthesia Programs: Current State and Guidance."[15] The purpose of the white paper is to guide programs' development of criteria for scholarly work as defined in the Standards for Accreditation of Nurse Anesthesia Programs: Practice Doctorate.[3]

Student Evaluation

All programs must evaluate students' knowledge and skills to ensure they are meeting the programs' stated objectives as they progress in the program. Evaluations should be anonymous and used to help develop and implement policies and procedures that utilize objective criteria to promote student learning while simultaneously enhancing the programs' quality and integrity.

Educational Methods

The methods used to deliver nurse anesthesia curricula are changing as new technologies are being applied in higher education. Based on COA 2020 Annual Report data and due to Covid-19 restrictions that required programs to discontinue face-to-face classes, 89% of nurse anesthesia programs reported the use of some form of distance education in their provision of didactic instruction.[16] Programs' distance education offerings vary from several core courses to programs in which the majority of the didactic curriculum is provided using distance education. In addition, all of the programs report having access to some form of simulation (e.g., simple models, computer, and full-body patient simulation). Standard E.11 requires programs awarding doctoral degrees to have simulated clinical experiences incorporated in the curriculum.[3] In addition, in 2015 the COA developed a position statement, titled "The Value of Simulation in Nurse Anesthesia Education."[17] The position statement identifies the advantages of simulation and how it relates to actual patient care.

Clinical Education

The clinical curriculum of nurse anesthesia education provides students with an opportunity to apply didactic knowledge in clinical practice. Programs prepare graduates with the knowledge and skills to administer all types of anesthesia, including general, regional, selected local, and moderate sedation to patients of all ages for all types of surgeries. Students use a variety of anesthesia drugs, manage fluid and blood replacement therapy, and interpret data from sophisticated monitoring devices. Additional clinical responsibilities include the insertion of invasive catheters, the recognition and correction of complications that occur during the course of an anesthetic, the provision of airway and ventilatory support during resuscitation, and pain management.

The COA standards require that students engage in a minimum of 2000 clinical hours and a minimum of 650 required cases. The types of cases are listed by age and physical status of the patient, technique, anatomy, and specialty type. These include call experiences and simulation activities. Specific directions are provided regarding how a case may be counted, the difference between administration of a technique and management of a technique, and differentiation between the various types of anesthesia services. Graduates of nurse anesthesia programs have an average of 9369 hours of clinical experience, including 733 hours during their baccalaureate nursing program, 6032 hours as a critical care RN, and 2604 hours (NBCRNA, written communication, May 2017) during their nurse anesthesia program.[18] To provide an authoritative reference for programs in advising students about recording of clinical experiences, in 2015 the COA published *Guidelines for Counting Clinical Experiences*.[19]

The requirements for students who enroll in nurse anesthesia programs on January 1, 2022, and thereafter is to complete a minimum of 650 anesthetics, which must include specialties such as pediatric, obstetric, cardiothoracic, and neurosurgical anesthesia.[2,3] The anesthesia experiences include the care of multiple patient characteristics including healthy patients critically ill patient, and patients of all ages for elective and emergency procedures. In most programs, the minimum number of clinical experiences is surpassed early in their clinical practicum. Based on CY2019 certification transcript data, nurse anesthesia programs provide an average of 851 cases, 1675 hours of anesthesia clinical experience, and 2573 total clinical hours for each student.[12]

Clinical Supervision

In 2019 the COA clarified the requirements for the clinical supervision of students stating CRNAs and/or anesthesiologists are the only individual(s) allowed to supervise nurse anesthesia students. CRNAs and/or anesthesiologists are responsible for the anesthesia care of the patient, and while supervising student, these professionals have the additional responsibilities of providing direct guidance to the student, evaluating the student's performance, and approving a student's plan of care.[20] The clinical faculty evaluates the technical and critical thinking skills of each anesthesia student. The entry into practice competencies for the nurse anesthesia professional are those required at the time of graduation, and focus on providing safe, competent, and ethical anesthesia care to patients for diagnostic, therapeutic, and surgical procedures (refer to 2004 Standards, Standard III, Criterion C21 and Practice Doctorate Standards, Graduate Standards, D1–D51).[2,3] Due to a lack in standardization in clinical assessment, in 2020 the COA developed and completed a Common Clinical Assessment Tool for use on a pilot basis by nurse anesthesia programs.[21]

It is important to note that the entry into practice competencies should be viewed as the structure upon which the nurse anesthetist continues to learn new facts, obtain and refine knowledge, and develop skills along the practice continuum that starts at graduation (proficient) and continues throughout the entire professional career (expert).

Affiliate Organization's Configurations and Relationships

In the 1970s the AANA bylaws were revised to allow for the establishment of four separate autonomous councils under the corporate structure of the AANA: the Council on Accreditation of Nurse Anesthesia Educational Programs (COA), the Council on Certification of Nurse Anesthetists (CCNA), the Council on Recertification of Nurse Anesthetists (COR), and the Council for Public Interest in Anesthesia (CPIA). The councils were established with the intention of informing and assuring the public that accreditation, certification, and recertification activities are within the discipline of nurse anesthesia and are separate from and not unduly influenced by the AANA. In the 2000s there were significant changes in the councils' structure. In 2007 the CCNA and COR separately incorporated to form the NBCRNA. The COA separately incorporated in 2009, and in 2010 the AANA members voted on a AANA bylaws change to not continue to recognize the CPIA. Subsequent to that action the AANA chose to not continue the independent activities of the CPIA and subsequently dissolved the council and subsumed its roles and responsibilities, distributing them across the organization's existing structure. The COA and the NBCRNA are solely responsible for their own internal affairs, including the election of officers, the creation and periodic modification of their bylaws, and the direction of their financial activities. Separate CRNA chief executive officers and boards of directors serve the COA,

the NBCRNA, and the AANA. In accordance with their bylaws, membership on the COA and NBCRNA boards include CRNAs, hospital administrators physicians, and members of the public. Membership on the COA also includes university and student representatives, and the NBCRNA has a designated surgeon and anesthesiologist member. To enhance communications, staff and board liaison roles were established in 2013 for the AANA, NBCRNA, and COA. Liaison representatives attend select sessions at the organizations' board meetings. In addition, communication among the AANA, COA, and NBCRNA is facilitated through regularly scheduled leadership meetings that include discussions on issues of mutual concern. More information on the AANA, COA, and NBCRNA can be found at www.aana.com, www.coacrna.org, and www.nbcrna.com, respectively.

Future Trends in Nurse Anesthesia Education

In 2014 a major step forward in specialization occurred when the COA adopted Standards for the Accreditation of Post Graduate CRNA Fellowships and procedures for the accreditation of postgraduate CRNA fellowships.[4] CRNA fellowships contain advanced education and training in a focused area of specialty practice or concentration. As of January 2021, there are five accredited fellowships in pain management and pediatrics.[22] While other specialty groups could eventually avail themselves of this education, the commitment is to focus on the nurse anesthesia community and to expand enrollment to other practice disciplines over time, based on demand and the adequacy of educational resources.

APRN Consensus Model

An important development for the practice of APRNs was the APRN Consensus Model approved in 2008.[14] This is a model for licensure, accreditation, certification, and education. The APRN Consensus Model identifies areas of educational specialization within advanced practice nursing that occur beyond the levels of role and/or practice foci. The APRN Consensus Model is not to be used as a source for regulation of practice, but rather to serve the individual nursing practitioners in their delivery of care and services. The National Council of State Boards of Nursing (NCSBN) has established a campaign for consensus and monitors state progression toward uniformity.[23] The future examination for specialty areas of practice by the CRNA, above the *role of nurse anesthetist* and the population foci of *across the lifespan*, should not be utilized as a gate-keeping mechanism to prevent any CRNA from engaging in any subspecialty practice. As long as CRNAs can demonstrate they have obtained the knowledge, skills, and abilities necessary to engage in a specialized area, individual practitioners should not undergo regulation via additional professional licensure. In 2015 the NBCRNA established a subspecialty credential (NSPM-C) in nonsurgical pain management.[24]

Full Scope of Practice Competency Task Force

In 2018 the AANA and COA supported a Full Scope of Practice Competency Task Force (FSOPCTF). The FSOPCTF's charge was to make evidence-based recommendations intended to continue to prepare nurse anesthetists to meet the needs in all types of practice settings. The task force spent over a year researching, discussing, and formulating its recommendations. It focused on education as the foundation of autonomous and independent CRNA practice. A total of 25 recommendations were made to the AANA, COA, and NBCRNA. To review and evaluate the recommendations, the COA established a Standards Revisions Subcommittee. In 2020 hearings were held and calls of comments distributed on proposed revisions to the Standards reflecting many of the FSOPCTF's recommendations. The COA made revisions to the Standards in 2021.[25]

CERTIFIED REGISTERED NURSE ANESTHETIST PRACTICE

CRNAs are advanced practice registered nurses licensed as independent practitioners who provide holistic, patient-centered comprehensive anesthesia, analgesia, and pain management services for patients across their lifespan, no matter the complexity of their health.[26] As leaders and decision makers, CRNAs work in collaboration with the interprofessional team that includes the patient, other health care professionals, and other qualified practitioners such as physicians (e.g., surgeons, obstetricians, or anesthesiologists), dentists, or podiatrists to provide high-quality anesthesia services.[27-29] Nurse anesthesia practice focuses on each patient's and team member's individual perspective and experience, as well as the importance of diversity, inclusion, and equity. This is described in the AANA's *Diversity, Inclusion and Equity Position Statement* and the *Professional Attributes of the Nurse Anesthetist* core values.[30,31]

Areas of Practice

There are four nurse anesthesia-related practice roles as defined by the NBCRNA. They are clinical practice, administrative, education, and research, or a combination of two or more of the areas of practice.[27,32] In their clinical practice role, nurse anesthetists administer approximately 45 million anesthetics annually for patients in the United States.[32] CRNAs provide comprehensive, patient-specific anesthesia services using anesthesia and analgesia techniques for surgical, obstetric, procedural, diagnostic, and chronic pain management procedures. CRNAs are the direct provider of all elements of anesthesia services in academic and community hospitals, critical access hospitals, ambulatory surgical centers, clinics, and offices, as well as the predominant anesthesia provider in US military, public health services, and Veterans Administration health care facilities. CRNAs are the sole anesthesia providers in nearly 100% of all rural hospitals and their respective communities, providing patients and families access to excellent obstetric, surgical, diagnostic, and trauma stabilization services and care.[32]

CRNAs are an integral part of the health care team, contributing their expertise in perioperative management that may include preanesthesia patient optimization, airway management, critical care, pain management, resuscitation, and other related clinical activities.[26,32] In the face of the opioid crisis, CRNAs have led practice changes to minimize or eliminate single modal opioid analgesia through multimodal pain management during the perioperative period. CRNAs have also integrated ultrasound-guided visualization for regional anesthesia and vascular access along with point-of-care ultrasound (POCUS) to improve the safety of the care they provide and improve patient outcomes. During the Covid-19 pandemic, when elective surgical procedures were canceled, CRNAs were sought and enthusiastically answered the call to lead critical care areas and specialty teams as APRNs. Federal leaders and state governors, in response to the demands of the pandemic, removed scope of practice barriers to allow CRNAs and other APRNs to practice to their full scope of practice and education.

In addition to their clinical practice role, CRNAs are businessowners or administrators, or practice in other leadership positions; participate with the team in quality improvement processes; lead research activities; are educators; collaborate in interdepartmental activities including policy development; and participate on various state and federal governmental agencies.[26,32] CRNAs educate and collaborate with their patients to provide informed, patient-centered health care. Another important role that CRNAs fulfill is that of didactic and clinical educators for nurse anesthesia students, as well as teaching other health care professionals specific skills related to their profession (e.g., flight nurses, medical students, respiratory therapists).

Today, market pressures continue to drive consolidation of health care facilities in local markets and across the country, as well as the growth of health care employment management companies to provide affordable, quality care.[33,34] As health care continues to transition from a reimbursement model based on fee for service to one grounded in value-based care and outcomes, the CRNA offers value and excellence in leadership, holistic patient care, quality, and cost-effective care.[34] To meet the needs of their community, CRNAs may practice in a variety of employment arrangements, such as self-employment, or employment by a health care facility, anesthesia group, health system, practice management company, university, military or clinic, or health care system.[34] In addition, nurse anesthetists practice in various models that include CRNA only, consultative CRNA/anesthesiologist arrangements where each provide anesthesia, or medical direction under an anesthesiologist with the CRNA providing the anesthesia. Each of the models are equally safe and of high quality; however, the CRNA-only and consultative models offer a high degree of cost effectiveness.[34]

CRNA Professional Credential

Professional certification indicates that the individual has met predetermined criteria that measure the knowledge, skills, attitudes, and judgments necessary for entry into the specialty of nurse anesthesia practice. Certification affords the public and employers an awareness of the qualifications and capabilities of health care providers. Consistent with the purpose of professional certification, the CRNA credential indicates that the individual who holds it has evidenced meeting the prescribed criteria necessary to provide the services described within a CRNA's scope of practice.[26,29]

To enter unencumbered practice as a CRNA, an individual must:

1. Comply with all state requirements for current and unrestricted licensure as a registered professional nurse in all states in which he or she currently holds an active license
2. Complete a nurse anesthesia educational program accredited by the COA or its predecessor within the previous 2 calendar years
3. Successfully complete the NCE administered by NBCRNA or its predecessor[29]
4. If applicable, apply for authorization to practice as a CRNA in the state(s)

The NCE eligibility requirements are available in the NBCRNA National Certification (NCE) Handbook, which can be found at www.nbcrna.com/publications/handbooks.

Continued Professional Certification

To maintain the CRNA credential, an individual must meet the requirements set forth by the NBCRNA in the Continued Professional Certification (CPC) Program. The comprehensive and rigorous CPC Program promotes professional development and lifelong learning to address changing accreditation requirements, the evolving health care environment, increasing autonomy of nurse anesthesia practice, and the integration of new technology regardless of practice setting, patients, and conditions. The CPC Program replaced the legacy Recertification Program, beginning in August 2016. The CPC Program is comprised of two 4-year cycles over an 8-year period. During the 8-year period, all elements of the program are repeated every 4 years except for the assessment exam, which is required only once every 8 years. In addition to documentation of practice and licensure, the program components include Class A and Class B credit requirements, completion of the four core modules, and the CPC assessment. In addition to completion of the CPC Program 4-year cycles for maintenance of certification, the CRNA must document his or her anesthesia practice, maintain current state licensure, and certify that he or she has no conditions that could adversely affect the ability to practice anesthesia.[29] Additional information regarding the CPC Program may be found at www.nbcrna.com/continued-certification. It is important to acknowledge that the CPC Program was initially designed to change over time so as to best meet the changing needs of the nurse anesthesia community, the larger health care environment, and the patients who are served by the care and services of the CRNAs in practice.

CRNA Scope of Practice

The AANA *Scope of Nurse Anesthesia Practice* broadly describes the professional roles, functions, and responsibilities as defined by the profession, while the individual CRNA's scope of practice is based on his or her personal education, licensure, experience, and skills.[26,35] The AANA *Nurse Anesthesia Practice Standards, Scope of Nurse Anesthesia Practice* and *Code of Ethics* provide the foundation for nurse anesthesia professional practice.[26,35-37] The *Scope of Practice* and *Nurse Anesthesia Practice Standards* are the foundation for the COA *Standards for Accreditation of Nurse Anesthesia Education Programs* (Table 2.1).[3,26]

The 2019 *Scope of Nurse Anesthesia Practice* addresses the responsibilities associated with clinical anesthesia practice working collaboratively with other health care providers, but is not limited to the services noted in Table 2.2.[26]

The *Scope of Nurse Anesthesia Practice* and the *Standards for Nurse Anesthesia Practice* are the authoritative statements that describe the minimum rules and responsibilities for which the nurse anesthetist is accountable. The standards apply to all anesthetizing locations and are intended to offer guidance for safe and high-quality anesthesia care.[36] Individual state or facility rules and regulations also define CRNA scope of practice. Anesthesia services evolve and change over time as research, evidence, technology, and new medications become available. The CRNA may reference AANA *Considerations for Adding New Activities to Individual CRNA Scope of Practice* to address decision points necessary for addition of new skills to his or her scope of practice.[38] It is also the responsibility of the CRNA to acquire the knowledge, skills, judgment, and experience necessary to safely practice within the scope of practice specific to state and facility policy.[37] More information regarding CRNA practice is available on the AANA website at https://www.aana.com/practice/practice-manual.

AANA ORGANIZATIONAL STRUCTURE AND FUNCTION

The AANA is a professional membership association that represents over 57,000 CRNAs and student registered nurse anesthetists nationwide. According to August 2019 AANA data, nearly 90% of CRNAs in the United States are members of the AANA.[32] The AANA was first incorporated in Ohio on March 12, 1932, as the National Association of Nurse Anesthetists (NANA). It was reincorporated in the state of Illinois on October 17, 1939, and designated as a tax-exempt organization in accordance with subsection 501(c) of the Internal Revenue Code; that same year, the organization's name was changed to the American Association of Nurse Anesthetists.[39] Following an AANA 2020 member resolution, the AANA is in the process of rebranding the association as the American Association of Nurse Anesthesiology.[40]

Information regarding the governance bylaws, policies, and guidelines of the AANA are available at https://www.aana.com/about-us/who-we-are or through the members login page at https://www.aana.com/governance. The bylaws address the classes of membership, decision-making procedures, responsibilities of the AANA's elected

TABLE 2.1 Crosswalk Between AANA Scope of Nurse Anesthesia Practice and COA Standards for Accreditation of Nurse Anesthesia Programs: Practice Doctorate

Element of Scope of Nurse Anesthesia Practice	Standard(s) That Address Element
Provide patient education and counseling	D25, D27, D28, D30, D33, D34, D35
Perform a comprehensive history and physical examination, assessment, and evaluation	D5, D6, D7, D8, D16, D25, D26, D27, D28
Conduct a preanesthesia assessment and evaluation	D5, D6, D7, D15, D16, D25, D26, D28
Develop a comprehensive patient-specific plan for anesthesia, analgesia, multimodal pain management, and recovery	D5, D6, D7, D13, D14, D17, D19, D20, D23, D33, D35, D38
Obtain informed consent for anesthesia and pain management	D5, D6, D7, D25, D28, D32, D35
Select, order, prescribe, and administer preanesthetic medications, including controlled substances	D5, D6, D7, D13, D14, D17, D20, D21, D22, D25, D26, D27, D28, D34
Implement a patient-specific plan of care, which may involve anesthetic techniques such as general, regional, and local anesthesia; sedation; and multimodal pain management	D1, D2, D3, D4, D5, D6, D7, D9, D10, D11, D19, D20, D21, D22, D26, D28, E2.1, E2.2, E2.3, and clinical experience requirements
Select, order, prescribe, and administer anesthetic medications, including controlled substances, adjuvant drugs, accessory drugs, fluids, and blood products	D5, D6, D7, D9, D10, D11, D17, D19, D20, D21, D22, D26, D28, E2.1, E2.2, E2.3, and clinical experience requirements
Select and insert invasive and noninvasive monitoring modalities (e.g., central venous access, arterial lines, cerebral oximetry, bispectral index monitor, transesophageal echocardiogram [TEE])	D5, D6, D7, D8, D13, D14, D17, D19, D21, D22, clinical experience requirements
Select, order, prescribe, and administer postanesthetic medications, including controlled substances	D5, D6, D7, D13, D14, D17, D20, D21, D22, D25, D26, D28, D29, D34
Educate the patient related to recovery, regional analgesia, and continued multimodal pain management	D5, D6, D7, D25, D27, D28, D32, D30, D33, D35
Discharge from the postanesthesia care area or facility	D5, D6, D7, D21, D22, D26, D28, D29
Provide comprehensive patient-centered pain management to optimize recovery	D5, D6, D7, D11, D17, clinical experience requirements, E2.2, E2.3
Provide acute pain services, including multimodal pain management and opioid-sparing techniques	D5, D6, D7, D11, D17, clinical experience requirements, E2.2, E2.3
Provide anesthesia and analgesia using regional techniques for obstetric and other acute pain management	D5, D6, D7, D9, D10, D11, D17, clinical experience requirements, E2.2, E2.3
Provide advanced pain management, including acute, chronic, and interventional pain management	D5, D6, D7, D9, D10, D11, D17, clinical experience requirements, E2.2, E2.3
Perform point-of-care testing	D5, D6, D7, D19
Order, evaluate, and interpret diagnostic laboratory and radiologic studies (e.g., chest x-ray, 12-lead ECG, TEE)	D5, D6, D7, D16, D19, E2.2, E2.3
Use and supervise the use of ultrasound, fluoroscopy, and other technologies for diagnosis and care delivery	D5, D6, D7, D9, D11, E2.2, E2.3, clinical experience requirements
Provide sedation and pain management for palliative care	D1, D2, D3, D4, D5, D6, D7, D9, D10, D11, D19, D20, D21, D22, D26, D28, E2.2, E2.3, clinical experience requirements
Order consults, treatments, or services related to the patient's care (e.g., physical and occupational therapy)	D5, D6, D7, D16, D17, D21, D22, D26, D27, D28, D32
CRNAs provide pivotal health care leadership in roles such as chief executive officer, administrator, manager, anesthesia services director, board member, anesthesia practice owner, national and international researcher, educator, mentor, and advocate	D25, D26, D31, D32, D33, D34, D35, D40
Nurse anesthetists are innovative leaders in the delivery of cost-effective, evidence-based anesthesia and pain management, integrating critical thinking, ethical judgment, quality data, scientific research, and emerging technologies to optimize patient outcomes	D25, D26, D13, D23, D31, D32, D33, D34, D35, D40, D44, D45, D46, D47, D48, D49, D50, D51
CRNAs engage in health care advocacy and policymaking at the institutional, local, state, national, and international levels. They also participate in professional associations focusing on patient access to quality and affordable care.	D25, D26, D13, D14, D33, D34, D35, D36, D38, D40, D41, D42, D43

From American Association of Nurse Anesthetists. Scope of *Nurse Anesthesia Practice*. Park Ridge, IL: AANA; 2020. Retrieved from https://www.aana.com/docs/default-source/practice-aana-com-web-documents-(all)/scope-of-nurse-anesthesia-practice.pdf?sfvrsn=250049b1_6; Council on Accreditation of Nurse Anesthesia Educational Programs. Standards for Accreditation of Nurse Anesthesia Programs: Practice Doctorate, Park Ridge, IL: COA; 2015. Retrieved from https://www.coacrna.org/wp-content/uploads/2020/01/Standards-for-Accreditation-of-Nurse-Anesthesia-Programs-Practice-Doctorate-revised-October-2019.pdf.

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