

You Trained at Mayo Clinic? Wow!

Mark A. Warner, MD



From the, Mayo Clinic College of Medicine and Department of Anesthesiology, Mayo Clinic, Rochester, MN.

Imagine the conversations at weekend bridge clubs, garden parties, and coffee shop counters in small towns across this country:

“My Dr Steinbrecker trained at the Mayo Clinic.”

“My Dr Zeller spent 2 weeks observing surgery at the Mayo Clinic.”

“My Dr Elliott went to a training course at the Mayo Clinic.”

These were more than statements—they were proud pronouncements, often accompanied by accolades.

As a boy growing up in rural western Ohio, it was clear to me that physicians in our small city, a county seat in a dairy heartland, were respected by most as stalwart citizens and revered by many for their extraordinary skills. They still made house calls; they prescribed sulfa drugs and penicillin; they cast broken bones; they delivered our best friends' baby sisters and brothers; and they operated and removed or repaired just about anything that might ail a person. In my mind's eye, I still perceive it as a near-idyllic medical environment in which the physicians were highly supportive of the citizenry and vice versa.

As kids, my brothers, friends, and I all knew of townsfolk who were sick. Small towns are like that. If people were really sick, they would go to one of Dayton, Ohio's, big hospitals or, perhaps, even over to Ohio State University in Columbus. But if they were really, really sick or no one knew what was wrong with them, they would mystically disappear for a few weeks—to somewhere called “the Mayo.” Most of us kids did not know much about “the Mayo” or that it was more than 600 miles away. However, we did know that when someone went there, it was extra special and triggered adult discussions, often after we kids were otherwise occupied and supposedly out of hearing range.

“Trained at the Mayo” was a mark of distinction that signified quality and judgment among physicians in my small city and countless other towns like them. I had faith that Mayo Clinic-trained physicians were excellent; almost everyone surely seemed to think

so. Yes, I suspect that other physicians were also of excellent quality. However, Mayo-trained physicians, even those who had been to Mayo for the briefest epochs, were perceived to heft more authority, speak more articulately and with greater eloquence, and serve more often as community leaders. Whether real or perceived, being a Mayo-trained physician was unique, special, and, to young kids, awe-inspiring because we could sense it from our parents and other adults who were credited with having great insights about such things.

What Makes a Mayo Education Special?

Staff who work at Mayo Clinic, whether they are physicians, scientists, other health professionals, or administrative and support personnel, know that they are responsible for teaching others. It does not matter what positions they hold; we have nearly 60,000 staff members and employees who understand that one of the expectations they carry is to train their successors and others to be better than they themselves are.

This sense of responsibility is not serendipitous; it springs from a culture inspired by Drs Will and Charlie Mayo (the Mayo brothers), and it is carefully, thoughtfully, and proactively passed along. Each orientation of new Mayo staff members includes historical vignettes, aphorisms, and specific conversations about continuing education to improve themselves and shouldering responsibility to train others, whether the trainees are potential colleagues, successors, or not.

The Mayo brothers, together, were a remarkable force. By all accounts, they were great surgeons. They were visionaries, creating the multidisciplinary team model for health care delivery and leading national and international efforts to organize and improve medical care. They put their personal and institutional resources into basic and clinical research, firmly committed to advancing the science and application of medicine. Plus, in arguably their greatest moment, they gave a remarkable proportion of their personal wealth to a foundation that endowed medical education and research. The foundation, the Mayo Foundation for Medical

Education and Research, remains intact today and continues to support their vision to improve patient care in perpetuity.

This dedication to medical education did not happen by chance. Indeed, they developed the idea of sharing their knowledge with others over decades of clinical practice. They tested how to best teach others. For physicians, they first invited direct observation of their practices, and, subsequently, they selected individuals to join with them as trainees or, in Mayo parlance, fellows. For other health care providers, they imagined the type of colleagues they needed to work on multidisciplinary teams and then simply created the training programs that these colleagues needed.

One excellent example of how the Mayo brothers used education to build the workforce needed in their practices relates to their desire for safe, effective, and efficient delivery of anesthesia to their patients. During their second decade in practice, ether anesthesia was common but was difficult to deliver appropriately, and no group seemed interested in administering it. A simple solution: they taught Edith Graham, a nurse (and later Mrs Charlie Mayo), to provide anesthesia to their patients. She and subsequent nurses that she trained delivered ether anesthesia, again and again, in the rapidly growing Mayo surgical practice. With oversight by the Mayo brothers, these nurse anesthetists attained a level of competence, success, and safety that far surpassed the world's best previously reported results. As the brothers increasingly operated on sicker patients, they soon recruited physicians to organize anesthesia services and to oversee the care of their sickest patients. With their foresight, they, in essence, created and supported one of the earliest training programs in nurse anesthesia. This program, still in existence today, has the longest history of continuous service of any nurse anesthesia training program. Their recruitment of physicians to oversee anesthesia services provided by nurses and to introduce regional anesthesia (ie, neuraxial and peripheral nerve block with local anesthetics) also supported the developing specialty of anesthesiology.

The Surgeons Club as Their Model

The Mayo practice of the 1880s and 1890s thrived, in part, because of the drive of the brothers to gain new knowledge. For example,

they sequentially enrolled in postgraduate courses at the New York Polyclinic for Practitioners, where they learned from Dr Arpad Gerster, one of America's leaders in aseptic surgery, who incorporated the newly advocated ideas on antiseptics espoused by Drs Joseph Lister and Louis Pasteur. These courses, augmented by observations they made during visits to leading US and European surgical practices, supported the remarkable survival outcomes they established back in Rochester.

The Mayo brothers knew that they could improve. Consequently, they soon began making separate annual trips to teaching clinics and hospitals around the world. Although they benefited from these trips, they also recognized that the teaching quality varied greatly from site to site. They noted that some physicians were reluctant to share their full knowledge. In response, the Mayo brothers vowed that they would share everything they knew with visitors. As the number of observing physicians in Rochester grew during the 1890s and early 1900s, the brothers introduced a variety of improvements that aided teaching, including adding adjustable mirrors over their operating room tables to allow better views of the surgical field by visitors, using movable operating stands that could be positioned to allow better views, and creating a Surgeons Club.

The International Surgeons Club started in 1906 to support the increasing number of physicians who came to Rochester to watch the brothers operate.¹ The brothers provided initial funds to rent downtown rooms in which visiting physicians could meet in the evenings and review what they had learned each day. The brothers and other Mayo physicians would gladly accept invitations from the Club's members to present lectures on topics in their fields. Hundreds of physicians from around the world were members, and, from 1908 through 1916, the usual number of visiting physicians in Rochester each day ranged from 6 to 30. During several of these years, more than half of the visitors came from cities along the American east coast or internationally. With the establishment of a formal Mayo graduate school of medicine in 1915, the educational activities available for visiting physicians diffused to various clinical and biomedical science departments, and the Surgeons Club eventually disbanded.

The Major Transition: Formalized Medical Education

In 1915, Will and Charlie Mayo and their spouses founded and endowed, with the bulk of their personal wealth, what is now the Mayo School of Graduate Medical Education.² Their Mayo Foundation for Medical Education and Research was established in affiliation with the graduate school of the University of Minnesota, a relationship that thrived for more than half a century until the Mayo Foundation became an independent degree-granting institution in 1983.³ Currently, the educational initiatives begun by the Mayo brothers have expanded to include not only contemporary versions of the original programs but also new programs, as outlined herein.

Mayo School of Graduate Medical Education (Established in 1915).

Seventy-one graduate students or fellows enrolled in 1915, the first year of the (then named) Mayo Graduate School of Medicine.² On June 14, 1917, the first graduate degrees of the school were awarded to 2 women and 2 men physicians. Subsequently, more than 20,000 women and men have completed their postgraduate training at Mayo Clinic. These graduates have practiced and led medicine in more than 140 countries. Today, the Mayo School of Graduate Medical Education oversees 141 accredited training programs, more than any other postgraduate school in the United States. The school supports an additional 130 nonaccredited subspecialty fellowships. The combined programs train more than 1600 graduate medical students at any one time.

Mayo Medical School (Established in 1972).

Forty students enrolled in 1972, the first year of Mayo Medical School.⁴ Since that time, more than 1500 students have graduated. Today, the school remains small but has become a significant contributor of faculty to academic medical centers throughout the country, including Mayo Clinic. Over time, it plans to establish a larger national footprint using innovations in education to drive new learning models at sites outside of Rochester.

Mayo School of Health Sciences (Established in 1973).

Although the Mayo School of Health Sciences was formally established in 1973,

Mayo Clinic has supported training programs in a variety of fields since beginning nurse anesthesia education in the 1890s. The Mayo brothers were early supporters of expanding the skills of nonphysicians to better support the multidisciplinary teams that they created to care for their patients. In addition to creating the concept of nurse anesthesia, they were early adopters or advocates of additional emerging fields in health sciences. For example, during Will Mayo's 1918-1920 presidency of the American College of Surgeons, he and Dr Franklin Martin, a surgeon widely acknowledged as the founder of the college, advocated for training nonphysician surgical assistants and technicians. Today, these allied health members of the surgical team, many of them trained at Mayo Clinic, are vital to surgical practice in the United States. Mayo physicians have either assisted with the development of or advocated for many additional allied health personnel roles and training programs to support them. Related to cardiac surgery, Mayo Clinic physicians and scientists played a major role in the early development and clinical introduction of cardiopulmonary bypass and established one of the first cardiovascular perfusionist training programs in the country. Allied health training programs in laboratory medicine (eg, histology technicians), rehabilitation (eg, physical therapists), neurology (eg, electro-neurodiagnostic technicians), and cardiac imaging (eg, echocardiology technicians) were among the first established in this country. Today, the Mayo School of Health Sciences oversees more than 60 accredited training and certificate programs as well as those that grant undergraduate and graduate degrees.⁵ Post-certificate or graduate experiences, including postdoctoral residencies, support the ability of Mayo Clinic to train its own workforce of the future and to diffuse these graduates throughout the country.

Mayo School of Continuing Professional Development (Established in 1977).

Initially focused on the education needs of practicing physicians, the Mayo Section of Continuing and International Education has evolved to its present form, the Mayo School of Continuing Professional Development, to support the continuing professional development of a broad swath of physicians and other health care providers. The

school was started to provide continuing medical education (CME) to physicians, and that activity still remains a major focus. Mayo's onsite CME courses are held worldwide.^{6,7} More than 120,000 participants annually receive Mayo Clinic educational credits and certificates. In addition, online Mayo CME activities reach physicians on all 7 continents. Mayo Clinic Online Learning programs offer innovative educational opportunities to physicians, allied health personnel, and students anywhere and anytime. The school also provides educational credit and certificates to nonphysician participants in many programs and in many fields of study. Altogether, the many and diverse continuing health professions education activities of the school make Mayo Clinic one of the largest health care educators in the world.

Mayo Graduate School (Established in 1989). Using its affiliation with the graduate school at the University of Minnesota, Mayo Clinic granted its first PhD degree in 1917. The creation of Mayo Foundation as an independent degree-granting institution in 1983, the expansion of biomedical science research funding available from the National Institutes of Health during the 1970s and 1980s, and the significant growth in size and scope of activities in the basic science departments at Mayo Clinic after the establishment of Mayo Medical School in the 1970s led to the opportunity for expansion of graduate student training in the early 1990s. The school currently offers PhD and master's degrees in 7 areas of specialization. Approximately two-thirds of its graduates enter academia, and the others typically are employed in industry.

Additional Education Activities

Will and Charlie Mayo's desire to share knowledge with visitors remains an important part of Mayo Clinic's mission. The institution pursues opportunities beyond formal education to fulfill this mission.

Clinical Reviews. The educational needs of visiting physicians (that were supported during the first part of the 20th century by the Surgeons Club) eventually transitioned to distinct educational programs. The first of these started in the early 1920s and were 1-week courses specifically dedicated to single

fields or topics. In general, they were oriented toward nonsurgeons; surgeons at that time had ample opportunity to observe procedures in the very large Mayo Clinic surgical practice. These "Clinical Weeks" for nonsurgeons were initially limited to 40 to 50 physicians, with this restriction helping to accommodate their experiences in limited clinical laboratory or office settings.⁸ Over time, these weeks grew so popular that the surgical specialties adopted them. Participants often came long distances to learn new diagnostic, clinical laboratory, and surgical techniques. For example, the 1927 Clinic Week in Urology hosted more physicians from New York than from Minnesota. By 1955, it was clear that visitors wished to learn a broad range of techniques and to hear about both medical and surgical issues. Mayo established its first Clinical Reviews program that year for more than 500 visiting physicians, surgeons, and others. This program has grown continuously since, with attendance often exceeding 1000 visitors per program. These programs provide a wide spectrum of courses, ranging from primary care through subspecialty medical issues, but always with a focus on presenting them to physicians who care for general patient populations.

Mayo Clinic Proceedings. The *Proceedings* was initially established as part of a larger medical communication program that was inaugurated by the Mayo brothers in 1907.⁹ That program included developing the Mayo Clinic library, editing publications written by Mayo Clinic staff, and supporting the dissemination of information to physicians inside and outside of Mayo Clinic. Maud Mellish, a former nurse and superintendent of a Chicago children's hospital, was hired to implement the program.¹⁰ She established the Mayo medical library and directed the Division of Publications. By 1919 she began the daily publication of *The Clinic Bulletin*, a series of reports and lectures compiled from local materials and external publications. This bulletin was distributed locally. From the early history of Mayo Clinic, the Mayo brothers had established weekly staff meetings to allow participants to share information on difficult or challenging cases, new methods of disease diagnosis and treatment learned locally or from travels elsewhere, and other topics. In 1926, Maude Mellish was

instructed to develop a new publication that focused on the content of these staff meetings and to organize the information for internal and external consumption. From April 21, 1926, through January 5, 1927, the new publication had a series of 4 different titles, ending with *Proceedings of the Staff Meetings of the Mayo Clinic*. The journal retained this title until 1964, at which time journal leadership was placed under the direction of an editor-in-chief and editorial board and the name was shortened to the current *Mayo Clinic Proceedings*. Today, the print version of the *Proceedings* is distributed worldwide to approximately 125,000 readers, and many more access its content daily through an active website and media coverage of its articles. It is the world's fourth largest print circulation medical journal of any genre, has content that focuses on general and internal medicine, and includes articles and commentaries by leading authorities from around the world.

Mayo Clinic Multidisciplinary Simulation Center. Mayo Clinic supports simulation activities with specific centers at its campuses in Rochester; Phoenix, Arizona; and Jacksonville, Florida.¹¹ It also provides simulation experiences in clinical settings. Its first major simulation center opened in Rochester in 2005. Simulation is used internally in most clinical fields to standardize practices, reduce medical errors, and build teamwork among practitioners. It increasingly is being used to support growing certification needs for physicians and other health care providers. Simulation activities are now integral to all Mayo clinical training programs and also to clinical practice in general.

Mayo Clinic Center for the History of Medicine. The Mayo Clinic Center for the History of Medicine was established in 2006. However, the institution has officially supported historical displays and projects since it established a historical committee in 1952.¹² The new center has positively impacted activities designed to promote awareness of Mayo Clinic's unique contributions to patient care, education, and research. The center has digitally recorded and archived a large number of institutional papers and artifacts, has organized and sponsored annual meetings of the

American Association for the History of Medicine and the American Osler Society, and supports 2 medical history interest groups: the Boerhaave Society for medical students and the Willius Society for residents and fellows. Museum displays for health care professionals and the general public are found at Mayo Clinic's Rochester, Jacksonville, and Phoenix sites.

Mayo Clinic Center for Humanities in Medicine. The Mayo Clinic Center for Humanities in Medicine and its governing Humanities Committee began in 1980 as a result of the success of the *Insight Series*, theatrical performances for Mayo Clinic staff intended to provide insight into medical issues as portrayed in great works of theater.¹³ Today, the mission of the Center for Humanities in Medicine is to support Mayo Clinic's primary value, "the needs of the patient come first," by integrating the arts and expressions of human culture into the healing environment. Humanities programs include performances of music, theater, and dance and exhibits of visual arts and lectures on relevant topics. The application of arts in the health care environment at Mayo Clinic predates the humanities programs, back to the first Mayo Clinic building in 1914. Distinctive and beautiful architecture have been characteristic of Mayo Clinic since its first buildings. Installations of works of visual art have been part of Mayo Clinic facilities planning since the Mayo Building was opened in 1955.

Mayo Clinic Libraries. By the time that the library was established in 1907,¹⁴ Mayo Clinic authors (including the father W.W. Mayo, sons W.J. "Will" Mayo and C.H. "Charlie" Mayo, and their early partners) had already contributed more than 270 publications to the clinical literature, including the earliest publication of W.W. Mayo in 1871 on the topic of tubular pregnancy in *Transactions of the Minnesota State Medical Society*.¹⁵ Like their father, the Mayo brothers had a desire to share, through their writings, clinical advances (particularly surgical advances taking place in Rochester) with colleagues around the world. Their publications were in the form of journal articles, books, and book chapters. Support for their research and writings required an organized collection of resources and services

rather than the haphazard collection of books and journals located in individual physician offices. As described previously, Maud Mellish was hired in 1907 to establish the infrastructure to support the growing research and publication efforts of Mayo Clinic authors and the learning needs of the growing number of physicians coming to Rochester to study.¹⁰ This resulted in a medical library (now Mayo Clinic Libraries), an editorial service (now Section of Scientific Publications), and medical illustration (now Media Support Services). The first building actually owned by the early partnership and not rented from others was erected in 1909 and housed the library and other services. Today, Mayo Clinic Libraries' support of learning, clinical care, research, and scholarship is an institution-wide effort accomplished through specialized services, physical facilities, and technology-enabled infrastructure that are essential and vital components of Mayo Clinic's success.

Mayo Clinic Quality Academy. Mayo Clinic has a long-standing commitment to quality improvement. In the first several decades of the 1900s, the Mayo brothers worked in collaboration with Dr Ernest Codman to improve patient care. Dr Codman, a Boston surgeon widely acknowledged as the founder of outcomes management in patient care, worked closely with the brothers and established the American College of Surgeons' Hospital Standardization Program. This program later became the Joint Commission on Accreditation of Hospitals (now the Joint Commission on Accreditation of Healthcare Organizations).^{16,17} During the past decade, there has been recognition on the part of institutional leaders that formal staff training in quality improvement methods is essential to moving Mayo Clinic farther and faster toward achieving its clinical, educational, and research objectives. Therefore, in 2006, the Quality Academy was established with the goal of creating a portfolio of courses focused on creation of value (quality, safety, service, and cost).

The hallmark of the Quality Academy is a Mayo Quality Fellows Program. The purpose of the fellowship program is to provide an organized training approach for individuals to learn, develop, and apply new knowledge for quality improvement. The fellowship program has a broad-based audience of physicians, nurses, and

allied health and administrative professionals. The goal of the outcome-based program is to increase individual and team-based knowledge of the skills and tools needed to define, measure, analyze, improve, and control quality improvement efforts. To date, more than 30,000 Mayo Clinic employees across the enterprise have participated in the Quality Fellows Program.

Next Steps for Mayo Clinic Education

Mayo Clinic remains committed to sharing its knowledge. A variety of existing activities and new programs currently in development will provide access to that knowledge, in face-to-face interactions, traditional education settings, or electronic media. For example, MayoClinic.org is one of the most often accessed online resources for health information in medicine globally, and it is used by both the public and health care professionals. *AskMayoExpert* and *Mayo Clinic Online Learning* are new resources for health professionals. These are currently under development and being tested internally. Each school within Mayo Clinic is working with clinical and biomedical science departments to understand their future workforce needs and adapt their training programs to provide highly skilled and educated graduates who will meet those needs. Educating our future colleagues, whether they remain at Mayo Clinic or go elsewhere, continues to be a core mission of all Mayo staff.

Correspondence: Address to Mark A. Warner, MD, Department of Anesthesiology, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (Warner.mark@mayo.edu).

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