

## Invited Editorial

# The Case for a Single Entry Level into the Perfusion Profession by 2020

Joseph J. Sistino, PhD, CCP

*Medical University of South Carolina, Charleston, South Carolina*

Cardiovascular perfusion is a very small profession with only 16 perfusion education programs in the United States graduating approximately 130 students annually. Since 1969, there has been a combination of perfusion programs based at both universities and hospitals. Currently there are three different entry levels into our profession: postgraduate certificate programs, Master's degree programs, and baccalaureate degree programs (1–3). What is the rationale for having three different entry levels into the profession?

Multiple pathways to a perfusion career are derived from the time period of Jim Dearing and Charlie Reed and their inability to agree on an ideal educational model for our profession. In 1969, more than 50 years ago, Jim Dearing started the B.S. program at Ohio State University and 10 years later began a B.S. program at the Medical University of South Carolina. He made a strong case for a university-based education in *Cardiac Surgery* by Dr. John Norman published in 1972 (4). In this book, Dearing wrote about the importance of an academic foundation before clinical training for perfusionists. Charlie Reed left Ohio State at Dr. Cooley's urging and founded the THI School of Perfusion Technology. Perfusion practice has changed dramatically since their time as a result of advances in membrane oxygenator and centrifugal pump technology, cardioplegia, blood management and conservation, cardiac assist devices, and neonatal heart surgery. In 1967, the average pediatric patient weighed 30 kg and today more than 25% of all pediatric patients weigh less than 5 kg (5).

In contrast, medical school training was standardized following the Flexner report in 1903 when the apprenticeship form of medical education was changed to include 2 years of basic science classes followed by 2 years of clinical training. Many other health professions started formalized training programs over the next 25 years. Recently, pharmacy changed from a 5-year B.S. degree to a Doctor of Pharmacy as a requirement for the pharmacy licensing examinations. Physical therapists have a deadline of 2015 for all accredited programs to become Doctor of Physical Therapy. Nurse practitioners (including nurse anesthetists) have adopted a deadline of 2025 for all accredited programs to award a clinical doctorate. The case for these changes is based on the increased education and knowledge base required to practice in these professions.

As the U.S. population ages, the increasing prevalence of chronic disease and complex medical conditions will have profound implications for the future of the perfusion profession. Based on changing demographic characteristics and expanded medical coverage under the Affordable Care Act, the demand for cardiac-related health services is expected to grow by 20% between 2013 and 2025 (6). Patients presenting for surgery with more complex and chronic conditions have increased the risk for mortality and morbidity. The aging population and new cardiac assist devices will require an increased knowledge base for adult perfusionists. As we operate on more complex cardiac problems in neonates, the knowledge base for pediatric perfusionists will also need to increase as a result of the continued demand to reduce mortality and morbidity in these high-risk patients. Therefore, the requirement for individuals entering the perfusion profession will entail greater depth and study in educational programs, and this is most compatible with graduate-level education.

For many practicing perfusionists, certificate program education provided an excellent clinical education experience;

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Address correspondence to: Joseph J. Sistino, PhD, CCP, Medical University of South Carolina, 151B Rutledge Avenue, Charleston, SC 29425. E-mail: sistinoj@musc.edu

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however, the resources necessary for an optimal didactic education are often lacking. Board scores and passing rates for academic programs vary depending on the amount of didactic training. Scientific presentations at national perfusion conferences are an important indicator of quality education. The majority of the research presentations are from university-based programs because these programs support and encourage scholarship in both their students and faculty. Perfusion students, under the direction of perfusion school faculty, present their research projects at these meetings and make significant contributions to the generation of new knowledge in the field. After the formal peer review process, many of these studies are published in one of the professional journals.

In 2010, a report on health professionals' education, "Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world," was published, which outlined major changes in medical education since the Flexner Report (7). The report stressed the importance of developing core competencies. These competencies should include patient-centered care, interdisciplinary teams, evidence-based practice, continuous quality improvement, and use of informatics. University education is based on the premise of preparing students for a career that will endure as technology changes. Incorporating evidence-based medicine and quality improvement into clinical practice requires a strong foundation in research skills. Interprofessionalism was also stressed in this report as an important component of health professionals' education. Interprofessionalism courses are mandatory in many universities to improve communication among health disciplines. Interprofessionalism training has been shown to reduce medical errors by enhancing teamwork and breaking down the hierarchy between healthcare providers. This has been recognized as a critical component in early health professionals training.

Educational facilities at universities for perfusion students are often superior to those at hospital-based certificate programs. Advanced educational technology, including, for example, the ability to record lectures, Smart Boards, and audience response systems as well as comprehensive access to literature, is available at universities. An important distinction between hospital-based and university-based programs is the priority of didactic education during the initial portion of the curriculum. Once students are engaged in the clinical portion, they begin to incorporate their academic knowledge into clinical practice. This is in contrast to apprenticeship training, which starts with early hands-on experience. The disadvantage to the apprenticeship approach is that the opportunity to develop a solid academic foundation may be missed as a result of clinical obligations. This was the same issue confronted by medical schools. They had to change

their model more than 100 years ago because there was significant cognitive knowledge that had to be learned and tested first before applying it to real patients. Imagine how much more information there is to learn today to create a solid foundation for clinical practice!

An important aspect to becoming a competent perfusionist is learning the technical or psychomotor skills. In the past, perfusionists learned on the job in the operating room. It was efficient for the times but should not be the model by 2020. Today, many university-based perfusion programs have high-fidelity simulators that can be used to teach both basic perfusion skills as well as crisis management of perfusion emergencies (8). Many hospital-based programs are unable to make the financial investment to purchase a high-fidelity simulator. Many of these programs continue to train using buckets as patient reservoirs. Some basic perfusion skills may be learned this way, but this is not high fidelity. With high-fidelity simulation, a cardiopulmonary bypass procedure can be conducted from beginning to end and test all skills—cognitive, psychomotor, and affective—in a highly realistic pressurized environment. Students can be videotaped to see how they react in different scenarios and situations. Communication skills can be practiced with other team members to attain competency. Once competency is established, the student starting performance level in the operating room is much higher than previous generations of perfusion students.

As noted earlier, the increasing complexity of the patient population as well as advances in technology necessitate expanding the knowledge base for perfusion education. The requirement for individuals entering the perfusion profession includes the ability to perform quality improvement studies and practice evidence-based medicine. Graduate education is based on learning and applying research skills critical to improving clinical practice. These skills will be particularly important as healthcare systems focus on improving outcomes and the demand for excellent surgical results in high-risk patients requires more advanced knowledge and skills. A graduate-level perfusion program is the optimal entry level into the profession.

There are already seven graduate-level perfusion programs. The path for baccalaureate programs to become graduate programs will be smoother with a firm deadline in place. The application for the transition to a Master's degree must undergo review by a state education authority. State review will require justification for this transition and a national mandate can expedite this process.

What about the existing certificate programs? Approximately 25% of perfusion school graduates today are from certificate programs, 28% from B.S. programs, and 50% from M.S. programs. Some certificate programs may choose to affiliate with a local university. Another option is for students to attend the universities for the formal didactic training and then have the clinical training at the

larger clinical sites. The undergraduate programs will have to transition to a graduate program by the deadline. There is significant time to prepare for a 2020 deadline. As a professional organization, we will have initiated steps for the betterment of our programs. In 1981, a deadline was set for the national certification examination that required graduation from an accredited perfusion program. That was a critical setup in the advancement and recognition of our profession.

The Standards and Guidelines for Accreditation of Perfusion Education Programs are reviewed every 5 years by its participating organizations. The current review is beginning now and should be completed within 1 year. The next review will be in (or around) 2020. It is my belief that it is in the best interest of the profession to establish a common graduate educational level by that time for all accredited perfusion education programs.

Having numerous entryways into our profession is confusing; there is no parallel in any other health profession. When asked, "What does it mean to be a perfusionist?," there should be no ambiguity regarding who we are, what we do, and our training status as practitioners.

We are indebted to all the perfusionists, including those trained on the job and certificate program graduates, who have contributed to the educational process and passed on

their knowledge as clinical and academic instructors. It is a privilege to be a perfusionist and play a critical role on the cardiothoracic surgical team. As we prepare students for the future, we should give them the best opportunity to succeed by providing the finest education possible.

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