

Original Article

Perfusion Education in the United States at the Turn of the Century

Alfred H. Stammers, MSA, CCP

Chairman, Perfusion Program Directors' Council, Program Director, Division of Clinical Perfusion Education, University of Nebraska Medical Center, Omaha, Nebraska

Keywords: perfusion education, perfusion manpower

Presented at the 37th International Conference of the American Society of Extra-Corporeal Technology, New Orleans, Louisiana, April 18–11, 1999 and the 14th Annual Mechanisms of Perfusion Meeting, Orlando, Florida, April 1999

ABSTRACT

The challenges facing institutions charged with the delivery of health care have also affected the delivery of education in the health sciences. In the 30 years since the establishment of a process for formalized perfusion education, significant changes have shaped how the fundamentals of perfusion sciences are learned. The establishment and maintenance of a profession can only be secured through the creation of standards that guide educational facilities in the delivery of formalized instruction in a discipline. Perfusion education programs continue to meet these standards but are doing so at a time where resources continue to dwindle and quantitative assessment of manpower issues are fuzzy, at best.

The peak of perfusion education programs occurred in 1994, and 5 years later only 25 programs were still accredited by the Committee on Accreditation of Allied Health Programs (CAAHEP). In the past decade, only one new education program has sought accreditation from CAAHEP. There were 41% fewer graduates in the United States in 1998 than in 1992, which follows a 6-year trend in declining numbers of individuals entering the field of perfusion. Individual programs are challenged by the reordering of university and community hospital structures, which often results in critical reviews of resource allocation to perfusion programs.

The health of the perfusion profession remains deeply tied to the success of perfusion education programs. Likewise, the health of these programs can only be assured by means of continued solicitation of support and guidance from practitioners who serve as stewards of perfusion technology.

Address communications to:
Alfred H. Stammers, MSA, CCP
Division of Clinical Perfusion Education
985155 Nebraska Medical Center
Omaha, NE 68198-5155
E-mail: astammer@umc.edu

INTRODUCTION

Perfusion education in the United States has undergone numerous changes in the 36 years since the first organized program in cardiovascular perfusion was established (1). The forces that influenced this evolution are diverse. The underlying principle, embraced by all, has always been to ensure that perfusionists entering the field possessed both a fundamental scientific knowledge of extracorporeal flow and the practical ability to provide patients with clinically competent care. No viable argument has been put forth that attempted to establish goals in conflict with these. However, the means by which the primary education in perfusion has been delivered has always been critically scrutinized (2-5). The goal of this paper is to examine some of the factors that have influenced how the delivery of primary education in perfusion has developed and to present the state of perfusion education in the United States today.

PROGRAM GROWTH 1963-1999

The first organized program in perfusion education began at the Cleveland Clinic in 1963, with the educational course taking approximately 6 months to complete. By 1969, there were a handful of programs educating students in the developing field of extracorporeal circulation. The first educational program based in a university setting started in 1969 at the Ohio State University (4). Through the 1970s, a number of educational programs were established in both hospital and university settings. In 1981, there were 15 accredited educational programs accepting students. By 1984, that number had expanded to 26, representing a growth rate of 3.3 programs per year. From 1986 to 1992, nine new programs were accredited, while some previously established programs closed. The greatest yearly number of perfusion education programs occurred in 1994, when the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association officially recognized 35 programs. Since that time, there has been a decline in the number of programs accepting students. In fact, since 1995, 10 programs have either closed or gone on "inactive" status (Figure 1). In 1999, 25 programs are accred-

ited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP), which took over the process in 1995 from CAHEA (Figures 2, 3). This is the 10-year nadir for perfusion education programs. Currently, 22 of the 25 accredited programs are accepting students for 1999 academic year. (One new program has accepted students and is in the process of applying for accreditation. This new program is the first to open since 1992.) The accrediting agency, the Accreditation Committee on Perfusion Education (AC-PE), is made up of representatives from seven member organizations. These organizations include the American Academy of Cardiovascular Perfusion, the American Association of Thoracic Surgery, the American Board of Cardiovascular Perfusion, the American Society of Extra-Corporeal Technology (AmSECT), the Perfusion Program Directors' Council, the Society of Cardiovascular Anesthesiologists, and the Society of Thoracic Surgeons. At this time, programs are equally divided between hospital- and university-based sponsorship (Figure 4).

PERFUSION GRADUATES

The number of new perfusionists entering the field has always been of concern to all vested parties (6). Thoracic surgeons and hospitals have expected that a ready number of competent graduates would be available to meet employment demands. Perfusion service companies have looked to the programs to provide a consistent number of graduates that would meet the market demand for perfusionists. These expectations, however, have not been met consistently for a number of reasons.

Manpower demands for perfusionists have followed the growth in cardiovascular services, and, hence, are also susceptible to market factors. Over the last 30 years, the expansion in cardiac surgery has been described as explosive. Employment opportunities were abundant for perfusionists in the 1970s and 1980s, but they stabilized in the 1990s. The demand for perfusionists outpaced the supply, which led to shortages in the early and mid-1980s. This led to an expansion in the number of schools, with an output of perfusionists that peaked in the early 1990s at approximately 215 graduates per year (Figures 5, 6).

Commission on Accreditation of Allied Health Programs accredited programs = 25

University of Arizona Health Sciences Center	Cleveland Clinic Foundation
Quinnipiac College	Ohio State University
Walter Reed Medical Center	Christ Hospital
Barry University	Hershey Medical Center
Rush University	University of Pittsburgh Med. Center
University of Iowa Hospital	Duquesne University
Johns Hopkins Hospital	Hahneman University
Northeastern University	Medical University of South Carolina
University of Nebraska Medical Center	The Vanderbilt Clinic
Cooper Health System	Texas Heart Institute
SUNY Health Sciences Center	Milwaukee School of Engineering
Inactive - Not Accepting Students	
St. Vincent's Hospital	Episcopal Hospital
University of Minnesota Hospital	

Figure 1.

Perfusion Education Program Location

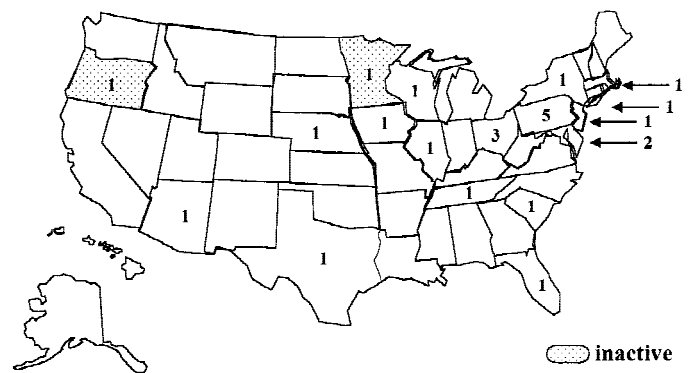


Figure 2.

**American Accredited Perfusion Education Programs
1989-1999**

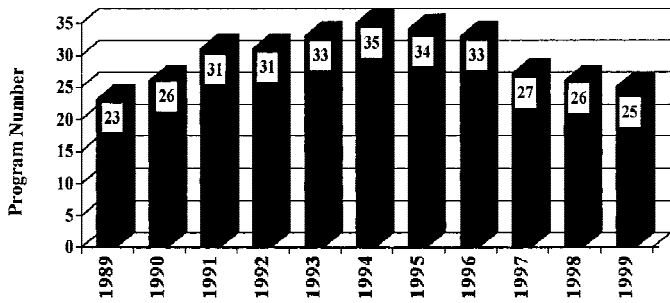
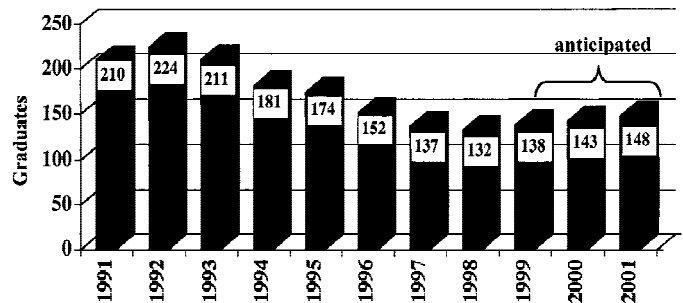


Figure 3.

**Perfusion Education Program Graduates
1991-1999**



*The three year attrition rate for students is 16.6%

Figure 6.

Perfusion Education Sponsoring Institution

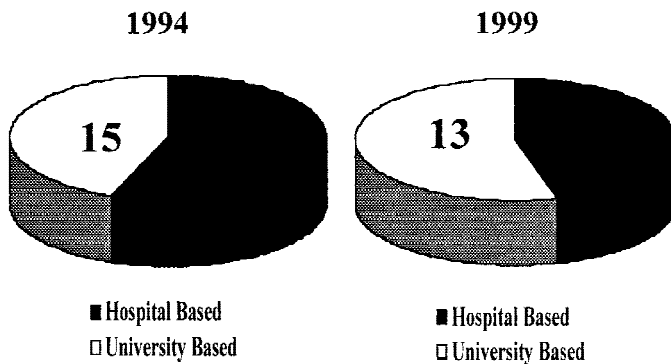


Figure 4.

**Perfusion Education Program Admissions
1991-1999**

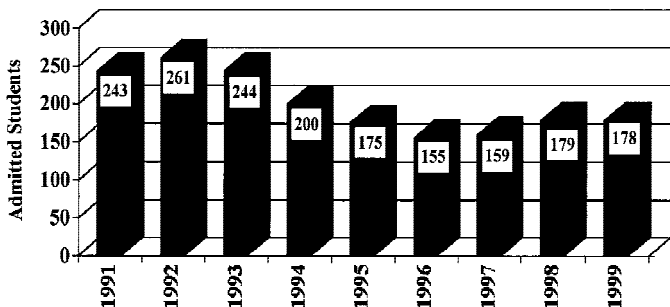


Figure 5.

Many believe the overabundance of perfusionists in the 1990s resulted when a number of factors occurred simultaneously. An increase in perfusion graduates happened concurrently with an expansion of percutaneous transluminal angioplasty. Unfortunately, this followed the period when the shortage of qualified clinicians forced perfusionists to alter their scope of practice by reducing the number of services provided to hospitals. As market forces shifted to take advantage of demand economics, perfusionists saw a decline in starting salaries and reduced

opportunities for employment. Many perfusionists blamed perfusion education programs, and their output of graduates, for these conditions (7). However, this proved to be an overly simplistic interpretation of events that were multifactorial.

Control of the number of perfusion graduates is a complex phenomenon that cannot be turned on or off easily. The generation of a new program is a slow and laborious process that is both difficult and expensive. It may take up to 4 years for a perfusion education program to form, gain accreditation, seat its first class, and graduate its first students. The factors used to support the development of a program may no longer be in existence by the time the program experiences its first graduation. Costs associated with beginning an educational program are significant, and few, if any, programs are totally self-sufficient. Manpower issues in providing a consistent educational program are twofold in perfusion education, because most perfusion programs have few students and program directors with diverse responsibilities (8). Furthermore, the ability of a program to meet the requirements of state education commissions imposes further demands. This may result in programs seeking sponsorship from hospitals instead of colleges or universities (Figures 7-10).

Perfusion Education Program Characteristics

	All Programs	University	Hospital
Program Length	19.9 ± 3.5	20.0 ± 3.5	19.7 ± 3.5
Award at Graduation	Bach. 4	Bach./Cert. 2	Masters 3 Cert. 15
Graduation Rate Per Program	Mean 5.8	Median 3	Range 2 - 20
Tuition	In-State range \$4,000 - 37,414 mean \$15,866	Out-State range \$9,000 - 37,414 mean \$19,969	

Figure 7.

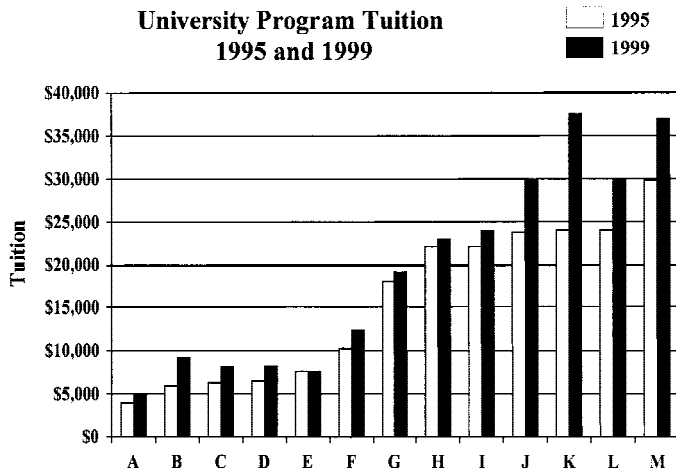


Figure 8.

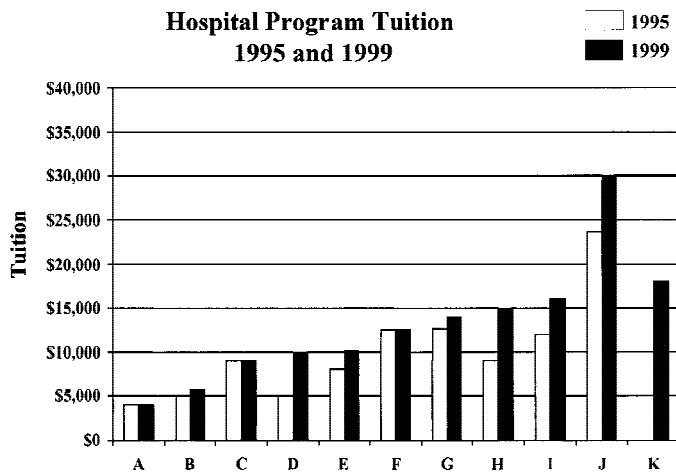


Figure 9.

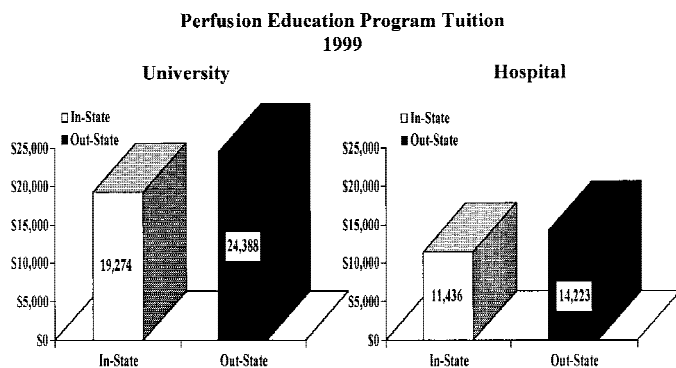


Figure 10.

EDUCATIONAL LEVELS

Primary education in perfusion is performed in two distinct types of institutions: teaching hospitals or universities (7). The delineation is not as clear as it seems, because universities all

use teaching hospitals in some phase of their educational process. Instructors at hospital-based programs also use principles of instruction based upon sound academic principles, which may not be overtly different from those established in formal education facilities. Clearly, delineation of the quality of education based upon the type of institution at which it is delivered is crude at best (9). This is discussed in detail in another section.

Three levels of awards are presently given to graduates of perfusion education: certificates, baccalaureate degrees, and master's degrees. The level of award depends upon a number of factors and is usually related to the type of sponsoring institution. However, some university-based programs offer certificates of completion upon graduation. Some programs listed as baccalaureate programs in promotional literature offer this degree level only to students with a previous baccalaureate. Those who have such a degree will, instead, be given a certificate upon graduation.

As of 1994, all individuals who graduate from a CAAHEP-accredited program must possess the minimum of a baccalaureate degree to enter the profession. Therefore, programs that offer a certificate of completion must require that students possess baccalaureate degrees prior to matriculation. In 1999, three programs offer master degrees in perfusion and a fourth offers a certificate in perfusion, with a master's in pharmacology. There is a trend toward master's level education for perfusion, with several programs currently in some phase of planning for the advanced degree. If we consider that the certificate programs are all postbaccalaureate, then it is clear that most perfusion education in the United States is performed as post-graduate work. Because, in 1999, only six of the 24 programs are at the undergraduate level, it seems likely that the future of perfusion education will be directed toward achieving status at the postgraduate level.

COSTS OF EDUCATION

Examination of budgets for perfusion programs reveals that the most significant costs for education are personnel related. The challenge that each program faces of hiring and retaining qualified faculty is only one aspect of the financial problem faced by most programs. Indeed, the most often stated reason for closing a program is related to finances. The major portion of an educational program's revenue is generated from tuition. Even in state funded programs, some portion of the operating budget comes from student tuition. The mean number of graduates per program in 1999 is anticipated to be 5.8, with a range of two to 20. It is evident from these low numbers that the financial support from programs must come from alternate sources.

The primary administrative position for each program is the program director, who usually serves as the key faculty person. Of the 22 accredited programs, 20 have program directors who are certified cardiovascular perfusionists. In the majority of cases, financial support for these directors comes either par-

tially, or entirely, from clinical enterprises. Although this may seem to be a desirable means to bridge the gap between theoretical and applied education, it places significant challenges on the director. The director's responsibility is to ensure that the quality of education received by each student is commensurate with the expectations of all stakeholders. These include the students, the faculty, potential employers, and ultimately the patients. Balancing these needs requires the directors to devote a significant part of their workdays to meeting program needs, while meeting their clinical responsibilities as well (8). Educational quality may be affected by such requirements.

ASSESSMENT OF QUALITY

The measuring tools used to assess the quality of an education program are influenced by a number of factors. The least of these is any consensus on what characteristics are deemed necessary for clinical competence. Efforts have been made to classify all education programs according to either the sponsoring institution (hospital or academic) or the level of award granted (degree or certificate). Neither classification has been shown to reflect issues of quality adequately. One important reason is that each educational program must adhere to a series of operational guidelines generated and approved through organized efforts of both the AC-PE and CAAHEP. These are termed the *Standards and Guidelines for an Accredited Educational Program for the Perfusionist*. These were initially adopted in 1980 as the *Essentials and Guidelines* and were revised in 1989 and 1994. All programs are periodically reviewed to ensure that they adhere to these statutes for perfusion education. The periodic assessment includes both written documentation and an on-site review of resources. These standards, however, are deemed by most individuals to be a minimum set of operational guidelines. It always behooves a program to consistently improve its function in providing an education that is commensurate with the needs of employers, and ultimately, patients. It is through the review of outcomes that program administrators and faculty members embark upon quality management processes for self-improvement.

Salient indicators of program quality can be divided into two categories: academic and clinical. Academic indicators for quality include the results of program graduates on the American Board of Cardiovascular Perfusion national examinations; student selection for national scholarships; student publication and presentation rates at regional and national meetings; and employment rates at graduation. From a clinical perspective, quality indicators include the type and breadth of clinical experience; the total number of cases conducted by the student; and the level of competence of program graduates. The latter indicator is only achieved through review of graduates' performance from their employers. Such an assessment, therefore, comes from discussions with perfusionist employers and is open to the interpretation of the individual giving the recommendation and the person receiving it. This quality measurement may be the most important of all indicators for a number

of reasons. The measure of success for a clinical perfusionist is ultimately related to his or her ability to support the clinical function of the institution where he or she is employed. Achievement of these goals always supercedes other responsibilities of the clinician. The total number of clinical practitioners is relatively small, and the experiences of one employer with a particular graduate may influence, positively or negatively, the employability of further graduates of that program with a specific employer.

PREDICTION FOR FUTURE EMPLOYMENT DEMAND

Predicting demand forces that influence employment opportunities for new graduates is difficult, and most information available for analysis is anecdotal. Another allied health profession, that of physical therapists, has undergone program development similar to that of perfusion education. The need for physical therapists peaked during the middle part of this decade, and a large number of new programs opened to meet this demand. With the large number of programs, the supply of physical therapists quickly exceeded the demand, and this year the American Physical Therapy Association called for a moratorium on opening new programs.

In 1991, the results from a 1990 survey of program directors were published in *Perfusion Life* (6). Predictions were for the number of graduates from accredited programs to grow and stabilize at around 220 per year. These results predicted a readily consistent number of graduates through the mid-90s. As we can see from the present survey results, this turned out not to be the case, and has influenced the employment opportunities for new graduates. The employment rate serves as a primary indicator for the market. Although individual programs maintain these data, no attempt has been made to gather this information in an objective format. The most useful information would undoubtedly come from surveys conducted by such national organizations as AmSECT. Until that is accomplished, most of the information that could help determine how programs could best adjust the number of individuals entering the field continues to be elusive.

SUMMARY

The state of primary perfusion education as we enter the 21st century is one of turmoil. We have seen the closing of 30% of perfusion education programs in the past 5 years, and undoubtedly, this trend will continue. The interpretation of these closures must be considered from a critical perspective devoid of emotional influences. Financial constraints that now confront hospitals and educational institutions continue to have a negative impact the delivery of education. What may be deemed 'good' for an individual may not be what is appropriate for a profession or a society. The challenges that the perfusion community must face include defining what indicators of quality are necessary to judge the performance of program graduates.

Once these are established, program officials must incorporate these requirements as benchmarks for self-evaluation. Changes to curricula, and most importantly, to ideologies, must be made to ensure that program graduates are not only prepared to find fruitful employment upon graduation, but also to perform with a level of confidence commensurate with their skills. Only through such dedication can perfusionists continue to control the fundamental criteria for entry into the profession. Otherwise, the outcome will be that the educational process will either be diminished or all together removed from perfusionists and placed in the hands of others less dedicated.

REFERENCES

1. O'Malley S. New kids on the block. *Perf Life*. 1991;8:8–10.
2. Hedzik K. Recent graduates talk about getting an education. *Perf Life*. 1993;10:10–16.
3. Stammers AH, Lange J. Controversies in perfusion education. Where do we go from here? *Perf Life*. 1992;9:10–19.
4. Lange J. The history of perfusion education in the United States. Proceedings of the Mechanisms of Perfusion Meeting, Orlando, FL. October, 1986.
5. Plunkett PF. Perfusion education in the USA. *Perfusion*. 1997;12:233–241.
6. Riley JB. Market forces affecting all levels of perfusion. *Perf Life*. 1991;8:6–9.
7. Hedzik K, Larrick K. Hospital-based perfusion education versus academic institution-based perfusion education. *Perf Life*. 1992;9:8–11.
8. Plunkett P. Perfusionist education in the United States: A future perspective. *Perfusion*. 1993;8:359–370.
9. Ferries L. Perfusion schools and new graduates: Quality versus quantity. *Perf Life*. 1994;11:8.