

From the Society for Vascular Surgery

The new training paradigms and the unfilled match positions of 2004: Will history repeat itself?

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Objective: The new millennium has seen an increase in vascular residency vacancies. The American Board of Vascular Surgery recently proposed new training paradigms, but their impact on recruitment remains unknown. We surveyed vascular fellows regarding factors and timing of career decisions to determine an optimal strategy for recruitment.

Methods: Surveys were sent electronically to vascular residents for completion. Data were analyzed using SPSS software. Additional data were obtained from the National Resident Matching Program.

Results: Of the 90 fellows that responded, 84% committed to vascular surgery during residency. Of these, 18% decided during postgraduate year 1, 54% by year 2, 84% by year three, and 95% by year 4. Sixteen percent of all trainees decided in medical school. Seventy-three percent of residents performed a minimum of 20 to 50 cases before reaching a decision. Among the group deciding between years 2 to 4 of residency, there was a significant difference in the number of vascular rotations before career commitment ($P = .0001$). In the 2004 Match, 21% of vascular residency positions were unfilled, up from 12% in 2003, 9% in 2002, and 4% in 2001.

Conclusions: Leaders in the field of vascular surgery have proposed focused training through the new paradigms. The incline in unmatched vascular residency positions over the past 4 years highlights the importance of a strategic plan to optimize recruitment. Few current trainees decided early in training about career choice, and volume appears critical to the decision process. Utilizing the current matching system (an 18-month process) and without any proactive change in recruitment, an integrated program after medical school would be reasonable for only 16% of applicants, or the 3+3 option for 54% of residents. For the new paradigms to be successful and to prevent more unfilled positions, increased medical student integration into vascular rotations and early active exposure to endovascular and open procedures during general surgical training will be necessary across the country. (*J Vasc Surg* 2006;44:145-50.)

The new millennium has seen an increase in vacancies in vascular surgery residency positions. During 2004, the Vascular Surgery Fellowship Match had a record number of unfilled positions, and the 2005 Match results duplicated the 2004 Match. This was in part due to the expansion of the number of training positions available, which decreased the ratio of available candidates per position. In 1997 there was a 35% surplus of candidates; in contrast, during 2004, there was a 10% surplus in vascular fellowship positions available.¹ In 2005, there was again an 8% surplus of positions. The number of active applicants increased only slightly over this same period of time (124 applicants in 1997 vs 110 in 2005). Calligaro et al² cited lifestyle concerns and potential loss of patients to other interventionalists as reasons among medical students and general surgery chief residents for not choosing vascular surgery as a career path.²

The anticipated shortage of surgical care providers for patients with vascular disease could prove to be challenging for vascular surgery over the next decade.³ Attracting suf-

ficient numbers of quality applicants may be difficult unless additional measures are taken.

Consequently, leaders within vascular surgery have a difficult task. They must grow the profession at a critical juncture in which our identity is changing with the evolving technology, ownership within the endovascular sphere is not well established, and alterations in training are necessary to prepare the new vascular specialist for the future.

The Vascular Surgery Board of the American Board of Surgeons is currently working on training paradigms to address the necessary preparation required for specialty practice. The new paradigms include an integrated track after medical school, transfer to vascular training after the third year of surgery residency (3 + 3), early placement after the fourth year of residency (4 + 2), and the traditional entrance after the fifth year of residency. Although it is evident that a strategic plan to optimize recruitment is crucial, the impact of the new paradigms upon recruitment remains unknown. We evaluated current vascular residents to determine the factors and timing of their decision process to enter vascular surgery to help determine the impact of the recently approved paradigms on future recruitment.

METHODS

Surveys were distributed by electronic mail to vascular surgery program directors accredited by the Accreditation Council for Graduate Medical Education. Ninety-one programs were contacted. Requests for completion of the web-based questionnaire were forwarded by the program

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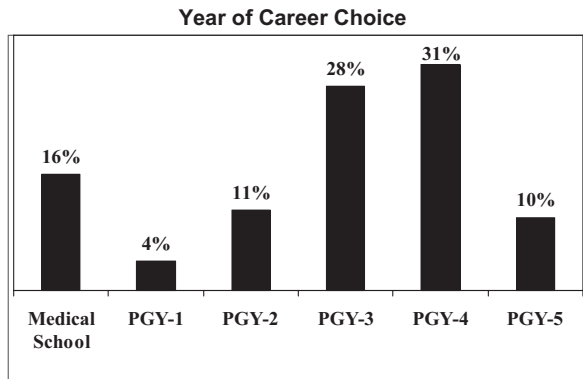


Fig 1. Year of career choice. *PGY*, Postgraduate year.

directors to the current vascular residents within their programs. The request was repeated three times in an effort to increase responses.

The survey consisted of 16 questions related to vascular career decisions and experiences during residency. Questions addressed the value of numeric caseloads and vascular rotations, the development of operative skills in relationship to years of residency training, and attractants that impacted career decision and place of fellowship. Personal identifiers were removed, and responses were entered into a database. Numeric data were analyzed with χ^2 tests and analysis of variance with SPSS software (SPSS, Inc, Chicago, Ill). Significance was assigned at $P < .05$.

Match results statistics for vascular surgery fellowship appointment years 1997 through 2005 were obtained from the National Resident Matching Program.

RESULTS

Responses were received from 90 of 110 fellows contacted, for a response rate of 82%. Of fellows from 2004, 16% decided on a career in vascular surgery in medical school, and 84% committed to vascular surgery during general surgery residency (Fig 1). Of these 84%, 18% decided during postgraduate year 1, 54% by year 2, 84% by year 3, and 95% during year 4.

During residency, 73% of fellows performed a minimum of 20 to 50 cases during residency before reaching a decision (24% performed 50 to 100 cases). Among the group committing between postgraduate years 2 through 4 of residency, there was a significant difference in the number of vascular rotations ($P = .0001$). However, there was no significant difference in case volume at time of decision. A certain number of cases must be performed before a definite career decision is made. This suggests different acquisition of cases per rotation from different institutions.

Although one third of fellows made a career decision during medical school or as a junior resident early in training, most preferred to complete their general surgery residency. When asked to describe the operative experience during the last year of residency, 43% thought it was

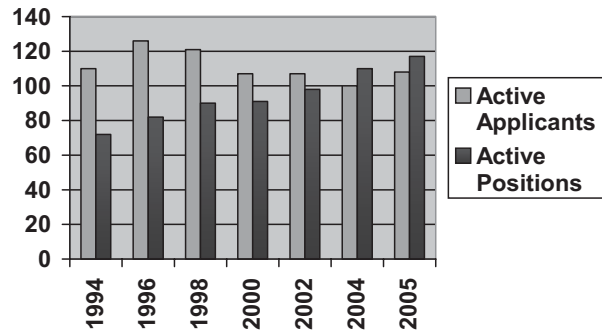


Fig 2. Vascular match statistics.

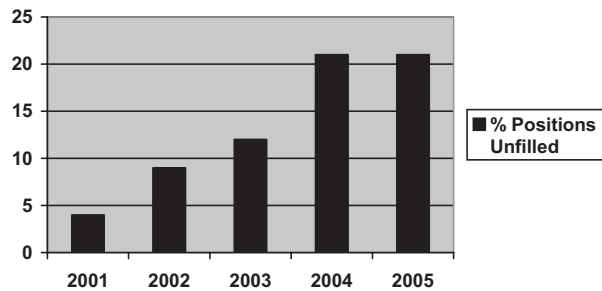


Fig 3. Match positions unfilled.

important for surgical development, 37% claimed it was invaluable, and only 20% would have preferred to start fellowship rather than gain more operative experience during residency.

Practice plans after fellowship completion amongst current fellows were entrance into private practice (24%), full-time academics (27%), or private practice with affiliation with a residency (17%). At the time of polling, 32% were still undecided about career plans.

Treatment with endovascular procedures was an attractant to the specialty for 97% of fellows and a deterrent for only 3%. An interest in participating in research during training was expressed by 51% of current vascular residents expressed, of whom 34% desired clinical and 16% desired basic science research.

According to the National Resident Matching Program (NRMP), there were 124 active applicants for 86 active positions in 1997,⁴ 100 active applicants for 110 active positions in 2004, and 110 applicants for 117 positions in 2005 (Fig 2). In the 2004 and 2005 match, 21% of vascular residency positions were unfilled, up from 12% in 2003, 9% in 2002, and 4% in 2001 (Fig 3). Upon further review, 57 programs (63%) have not experienced difficulty in the match from 2001 through 2004, while eight programs (9%) account for the vacancies occurring over multiple years. An additional 25 programs (28%) have had difficulty matching in a single year.⁴

DISCUSSION

In the 2004 and 2005 Vascular Fellowship Match, the number of fellowship positions filled was at a record low, with 21% of positions not filling each year, increased from 4% of positions in 2001 (Fig 3). Most “unfilled” positions in the match are subsequently filled by individuals who make a late decision. Over the last 9 years, the number of fellowship positions has increased. Although many fellowship programs have not experienced difficulty, approximately one third of all programs have failed to match at least once in the last 5 years. With the exception of a very small number of programs, the failure to match relates to the size ratio of the applicant pool vs the number of available programs rather than any program-related factors. Still, many quality programs have or will experience recruitment difficulty if the current problems are not addressed.

Revision of current training is necessary to prepare the future vascular specialist to manage the medical care of the vascular patient, be knowledgeable in noninvasive diagnostic laboratory studies, and acquire proficiency in both conventional and endovascular techniques. The effect of the new training paradigms on recruitment to the specialty is unknown, however.

Early entrance from medical school or after the third year of residency would enable basic general surgery training, but exclude complex general surgical procedures performed in the fourth and fifth year by those seeking general surgery certification. Integrated programs would be advantageous, because the vascular director would have more control of rotations during the first 3 years; however, programs may experience problems with attrition due to lack of adequate exposure during medical school. With the 3 + 3 or 4 + 2 option, programs will receive a “less trained” applicant. Less trained implies less experience than an applicant competing 5 years of residency.

More variability in experience is likely, with some training programs prioritizing more case exposure early and others providing more cases during the fourth and fifth years. Less exposure to major abdominal and thoracic procedures will occur, complicating teaching of complex open vascular cases. Gaps will also occur in general surgical programs as applicants leave for the 3 + 3 program, possibly creating a further schism between vascular and general surgery. The 4 + 2 or 5 + 3 (2) option awards the general surgery certificate, which may be a consideration for some applicants desiring to practice general surgery upon completion of the vascular fellowship.

Upon completion of training, 24% of respondents desire to enter private practice, and 32% were undecided at the time of the survey. Currently, many in private practice need to cover general surgery call or substitute caseload with general cases when starting a practice in the community. This is likely to change once graduates from the new training paradigms are in practice. However, any paradigm that completely eliminates the general surgery certificate

may deter potential candidates who enjoy general surgery and plan to practice both general and vascular surgery. On the other hand, the complex new endovascular procedures and interventions may eliminate the possibility of practicing both general and vascular surgery. Many general surgeons are not trained to perform endovascular procedures such as aortic stent-grafts or carotid stenting. These less-invasive procedures are replacing many of the traditional open operations for vascular disease.

Many vascular residencies include time for research, yet only 50% of fellows are interested in research, and even less show an interest in basic science research. Further, only 27% of current fellows plan on an academic career. With the changes in length of training, consideration should be given to the amount of time spent in dedicated research.

The vascular training components of the new paradigms are currently being defined, but would likely include vascular ultrasound, vascular medicine, catheter based procedures, and traditional open vascular surgery.⁵ This would fulfill educational goals to keep pace with the rapid expansion of knowledge and techniques within the field.

Plastic surgery training most closely mirrors the plan for application processes during medical school, third, fourth, and last year of residency. Despite little exposure in medical schools, the plastic surgery specialty has never suffered from lack of an abundance of candidates. The San Francisco Match Program, the universal plastic surgery match program for applicants with ≥ 3 years of residency training, reports that 66% of candidates match and 97% to 98% of programs fill.⁶ However, programs have a strong preference for matching applicants with ≥ 5 years of general surgery residency experience. In addition, the NRMP offers approximately 75 positions to medical students for an integrated plastic surgery program. When the two matches are combined, approximately 50% of applicants complete 5 years of residency. The success of plastic surgery programs with multiple entry points is consistently 97% to 98% per year.

Although one third of current vascular fellows made a career decision early in training, 59% of current trainees do not favor a shortened training. With this being a retrospective study, and people tending to favor continuing a pattern of training similar to that which they have undergone, it is difficult to predict what current students may desire. People that are currently in practice are from the Baby Boom era, and medical students now are from Generation X and have significantly different ideas about the role of career vs family. Current residents in the younger generation embrace the work hour limitations. If they were required to make a decision earlier and less general surgery training was required, it is possible that many would embrace the shortened path to a vascular career. Because our survey covered a narrow demographic group and did not include students, we can only speculate what the future medical student would desire for training options.

A different paradigm of training may be better able to recruit women. In a recent survey of surgical residents, women were more concerned than men about childrearing,

initiating and maintaining personal relationships, maternity leave, and promotional advancement.⁷ Lifestyle is valued by both sexes of Generation X, which makes this an important issue for surgery to address. Currently, the surgical lifestyle is viewed as difficult to reconcile with family life. Schwartz⁸ noted in the late 1980s that medical students with academic standings in the top 15% were choosing specialties with controllable lifestyles, such as emergency medicine, dermatology, anesthesiology, radiology, neurology, ophthalmology, pathology, and psychiatry. This shift would suggest that integrated programs may be more competitive for students than the traditional training programs. This may be especially true if students realize that the vascular surgeon can also have a controllable lifestyle.

A critical factor for attracting future applicants may be better "definition of the specialty." Currently, the identity of the specialty is in flux as change occurs from a conventional surgical subspecialty to a hybrid of surgery, medicine, and interventional procedures. As more vascular surgeons incorporate endovascular techniques into their practice, potential candidates will have fewer concerns about potential loss of patients to other specialists such as cardiologists, interventional radiologists, and neurosurgeons.⁹⁻¹¹

The evolution of the endovascular specialty has redefined vascular surgery and is having an increasing role in the training of vascular surgery fellows.¹² Ninety-seven percent of current fellows reported that endovascular surgery was an attractive feature rather than a deterrent. Recruitment of general surgery residents may become more difficult, because a larger percentage of our procedures are not considered index cases for general surgery residents and exposure to vascular surgeons and vascular patients decreases. General surgery program directors are trying to meet index case loads while working within the constraints of the 80-hour workweek, limiting non-index case coverage.

Vascular case volume was critical to the decision process among current fellows making their decision during residency. Before reaching a career decision, 73% of residents performed a minimum of 20 to 50 cases, whereas 24% had performed 50 to 100 cases. Among fellows who made a career decision between their second and fourth year of residency, there was a significant difference in the number of vascular rotations ($P = .0001$), but not in case volume. This implies that a critical minimum number of cases independent of the number of rotations were needed prior to decision. Most made a decision after being exposed to at least 20 to 50 cases, regardless of the number of rotations. The volume of cases and length of time per rotation provided by residency programs is inconsistent across the United States.

Early exposure alone may not be the key issue, but rather the quality of the encounter. Many in our survey cited a positive role model as an attractant to the specialty. Calligaro et al² have also cited the importance of mentoring. This is becoming more of an issue as many medical schools are shortening the third-year surgical rotation and the subspecialties are changed to a fourth-year elective.²

Polk¹³ reported nearly a 30% decline in obligatory rotations on the surgical specialties during the third and fourth years of medical school, and vascular surgery traditionally has not been a third year elective. In conjunction with work-hour restrictions and shorter rotations, contact time with trainees is likely to decrease, making positive mentorship experiences problematic.

CONCLUSION

To enable the new paradigms to fill and be functional, a concentrated effort by program directors and division chiefs to facilitate third-year student exposure to vascular surgery is mandatory. Stepwise integration of the new paradigms for early admission is necessary to avoid unfilled spots as programs embrace the new paradigms. Program directors need to continue an ongoing survey of students to determine the ability to increase the number of early training positions. Vascular surgery program directors should work with general surgery program directors to provide a well-mentored, hands-on experience for surgical trainees to give them a positive impression of vascular surgery early in their training.

AUTHOR CONTRIBUTIONS

Conception and design: PMZ, LMH

Analysis and interpretation: PMS, MOI

Data collection: PMZ

Writing the article: PMZ, MOI

Critical revision of the article: PMZ, MOI, MLD, LMH

Final approval of the article: PMZ, MOI, MLD, LMH

Statistical analysis: PMZ, MOI, MLD, LMH

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Overall responsibility: LMH

REFERENCES

1. Cronenwett JL. Vascular surgery training in the United States, 1994 to 2003. *J Vasc Surg* 2004;40:660-9; discussion 669.
2. Calligaro KD, Dougherty MJ, Sidway AN, Cronenwett JL. Choice of vascular surgery as a specialty: survey of vascular surgery residents, general surgery chief residents, and medical students at hospitals with vascular surgery training programs. *J Vasc Surg* 2004;40:978-84.
3. Stanley JC, Barnes RW, Ernst CB, Hertzner NR, Mannick JA, Moore WS. Vascular surgery in the United States: workforce issues. *J Vasc Surg* 1996;23:172-81.
4. National Residency Matching Program. NRMP Data Warehouse. Washington, DC: National Registry Match Program; 1996-2005 database.
5. Green RM. New training paradigms: the three-plus-three program. *Semin Vasc Surg* 2002;15:170-3.
6. Plastic Surgery Matching Program. San Francisco Match, San Francisco, CA 1992-2003 database.
7. Gabram S, Hoenig J, Schroeder J, Mansour A, Carnelli R. What are the primary concerns of recently graduated surgeons and how do they differ from those of the residency training years. *Arch Surg* 2001;136:1109-14.
8. Schwartz RW, Jarecky RK, Strodel WE, Haley JV, Young B, Griffen WO Jr. Controllable lifestyle: a new factor in career choice by medical students. *Acad Med* 1989;64:606-9.
9. Calligaro KD. Does the Vascular Surgery Board of the American Board of Surgery work? *Vascular* 2004;12:86-8.
10. Veith FJ. Leaving the nest: should vascular surgery seek board status separate from general surgery? *Semin Vasc Surg* 1997;10:81-4.

11. Kashyab VS, Ahn SS, Petrik PV, Moore WS. Current training and practice of endovascular surgery: a survey. *Ann Vasc Surg* 2001;15:294-305.
12. Kashyab VS, Ahn SS, Davis MR, Moore WS, Diethrich EB. Trends in endovascular surgery training. *J Endovasc Ther* 2002;9:633-8.

13. Polk HC. The declining interest in surgical careers, the primary care mirage, and concerns about contemporary undergraduate surgical education. *Am J Surg* 1999;178:177-9.

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DISCUSSION

Dr K. Craig Kent (New York, New York). Pamela, that was fabulous and certainly the pep talk we all need. I would like to translate the conceptual ideas you have presented into practical solutions.

We need to reach out to the medical students. We need to stimulate them. But how do we accomplish this? Most of the medical students, even when they rotate on surgical services, don't rotate on vascular surgery. So we really have no exposure to them whatsoever.

Even for the junior residents, with the exception of perhaps some of the endovascular techniques, many of our procedures are fairly complicated and not first-, second- and third-year resident cases. These are problems that, I think, plague all of us at our individual institutions. How do we get beyond these to accomplish what you've suggested?

Dr Pamela M. Zimmerman. This is a very important issue, as medical students are now spending less and less time on the surgical services. And even whenever they are on vascular surgery, most of the time it is only for 2 or 3 days during the rotation. This is an issue we can change if we can get medical students more involved in the vascular surgery service. And this really has to be addressed on a local level within the medical schools, and we need to work with deans and get more medical students on the rotations. This is actually something that we are working on at our institution, to try to get more time spent on the service, and we are also currently surveying medical school deans to see if they'd be willing to incorporate this into their programs.

Dr Keith Calligaro (Philadelphia, Penn). I applaud your efforts in following up with the survey that we performed at the request of the program directors that we presented at the SVS a year ago. I have two questions for you.

One, please tell me again the percentage of residents who would have decided retrospectively to go into vascular surgery by the middle of their second year. If I am calculating correctly, that's when they would have to choose a 3-plus-3 paradigm. And if I remember your percentages correctly, I believe it was probably only about maybe 20% of the residents who have decided by then. That means we are in a lot of trouble if we want to encourage people to choose the 3-plus-3 training paradigm.

You showed that the number of rotations that medical students or junior residents had in vascular surgery seemed to correlate with their choice of choosing vascular surgery. But were there any questions directed at the residents asking them about the quality of those rotations? In the survey we held, the results showed that a bad rotation in vascular correlates as well with not choosing vascular as a good rotation correlated with choosing vascular surgery.

Dr Zimmerman. For the first question, how many people would be qualified for each of the new tracks under the new training paradigms, we used an 18-month match process, which is currently in use. Retrospectively, 16% of the 90 applicants that responded would have been qualified, or they would have been potential applicants for the integrated or medical school track. So 16% made a decision in time to apply for that program if they desired an early fellowship training or early entrance into the program.

Looking at application time during the middle of the second year, the number that would qualify for the 3-plus-3 would be 31%, but that is also including the 16% that would be potential applicants for the medical school track.

The second question was asked about the quality, and it was not necessarily a direct question. But we did look at the case volume that was performed in relationship to the number of rotations. And as I had mentioned in the presentation, there were some people who would perform a rotation every year, but it wasn't until they actually had hands-on involvement in the cases before they would make their decision. There were people that were operating from their internship, that right away decided they wanted to be a vascular surgeon; but there were some people that didn't decide until the end of residency. Now, this could be because they were actually participating more in the cases later in residency or it could be because of procrastination, as many of us would procrastinate and not make a decision until late.

Dr John Ricotta (Stony Brook, NY). I want to just follow up on the operative experience issue. You know, medical students choose urology, neurosurgery, and ENT, with no operative experience. One of the things I'd like to see you either speculate on now, or perhaps focus on in the future, is how do we promote our specialty, other than the technical joy of doing the operation, which is why most of us got into it. If we go to these new paradigms, we are not going to be able to let people do aneurysms and fem-pops and carotids before they make their decisions. So I'd be interested in your thoughts as to how we promote our specialty in similar ways that the other specialties are promoting.

Then the second question I have is, in talking to some interventional radiologists, among the myriad of issues that they have now, one is the radiation issue. At least some of them tell me that they feel part of the reason that they are not getting female interventionalists is the concern over radiation. I wonder if you would comment on that.

Dr Zimmerman. That is a very good question about how to promote the specialty. This is actually something that we have thought about and I am not sure that we have a good answer. Whenever someone decides they want to be a plastic surgeon, they've decided before they go to medical school. They've already been exposed to the specialty through the media. They are aware of what the plastic surgeon does and they think that the plastic surgeon has a great lifestyle. If you ask the general medical student what a vascular surgeon does, they think that we operate on the heart or that we do venous procedures.

So this is where we need, I think, global education of what we really do. And it is hard to know the best way to really promote this, but we need to get the word out of what defines a vascular surgeon and our specialty. The one place that we can start is with the medical students.

Radiation is an issue for everybody. I know that some women don't like the issue of radiation. But as I was going through residency, there were also many men that did not want to be exposed to the radiation either. This is a difficult issue, because people are exposed to different amounts of radiation. Some of us perform cases in the operating room and some perform cases in the angiography suite. Our environment determines the amount of radiation we are getting exposed to. I am not sure what the best answer is to that because I think everyone is concerned about radiation exposure. Nobody wants to expose themselves to any unnecessary radiation.

Dr David Campbell (Boston, Mass). We haven't had so much trouble attracting people into vascular surgery as we have attracting medical students into surgery in general. Harvard Medical School students talk about the ROAD to success: radiology, ophthalmology, anesthesia, and dermatology. And 60% of our

students are making their career decision based on what time they get up in the morning and how many hours they have to work. Is this something unique to us, or are you seeing this too?

Dr Zimmerman. Actually, this is something that we are seeing globally, because medical students now prefer shorter training periods. Generation X, the current medical students, are really concentrating on lifestyle, and we do see an increase in anesthesiology; we see an increase in emergency medicine.

One way that we can really promote vascular surgery as an attractive lifestyle is through the endovascular procedures. The procedures are shorter and the patients stay in the hospital longer. There is more to vascular surgery than just an open operation. There is also the venous aspect. The endovascular aspect helps us to show that there is more to vascular surgery than just performing an operation.

Dr Julie Ann Freischlag (Baltimore, Md). When I ask my residents why don't they want to be a vascular surgeon, they tell me that if we had let them do procedures when they were a first- or

second-year resident, instead of just holding the wire way beyond the table, they may have chosen to do that. How do you propose to get younger residents into the operating room and doing part of these endo procedures, so we do get them to develop passion for the sport?

Dr Zimmerman. That is very interesting, because we actually see the opposite at our institution. The senior residents and the fourth year residents that have already decided on something else do not want to go into the angiography suite or they don't want to do the interventional procedures. The first year and the second year residents come in and they really like to do the procedures. Whenever they are there, they like to get actively involved. I think the key is to keep these people actively involved and keep their interest. Because we are seeing the interns, they are getting exposed earlier, whereas before, the initial exposure was not until the fourth year. I think the key here is once the first year and the second year resident is in the angiography suite with you, continue their interest in the specialty.