Nationwide survey of US integrated 6-year cardiothoracic surgical residents

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Objective: Integrated 6-year cardiothoracic surgical residency programs have recently been implemented in the United States. We report the results of the first published nationwide survey assessing the motivations, satisfaction, and ambitions of integrated 6-year residents.

Methods: A 63-question web-based survey was distributed to 83 residents enrolled in 21 Accreditation Council for Graduate Medical Education–accredited integrated 6-year programs in November 2013. There was an outstanding 69% response rate.

Results: The median age of integrated 6-year residents was 29 years with women comprising 24%. A clear majority had faculty mentorship (95%) and significant clinical exposure in medical school. Focused (100%) and abbreviated (74%) training curricula were identified as the top advantages of integrated 6-year programs; the format itself was a significant factor (46%) in career choice. Most integrated 6-year residents (95%) were satisfied with their program; 80.7% were satisfied with their operative experience thus far. Career plans skewed toward adult cardiac surgery (67%), followed by pediatric cardiac (24%) and general thoracic (9%) surgery; 49% were not particularly concerned about future employment, with 65% foreseeing an increase in opportunities. Specialized training (eg, aortic, heart failure, minimally invasive, congenital) was anticipated by 77%. Most integrated 6-year residents envision an academic career (94.7%).

Conclusions: This survey takes an important snapshot of the nascent integrated 6-year format. Mentorship and intense clinical exposure are critical in attracting applicants. Purported advantages of the format are holding true among integrated 6-year residents, with the majority satisfied with their programs. These early data indicate that this format holds significant promise in attracting and retaining highly qualified trainees to academic cardiothoracic surgery. (*J Thorac Cardiovasc Surg* 2014;148:401-7)

The past decade has witnessed a decline in the number of qualified applicants to US cardiothoracic surgical residencies, resulting in a surplus of unfilled training positions and closure of some programs.¹⁻⁵ This decline has occurred despite significant technologic advances in the field, a growing proportion of older patients with cardiovascular disease,⁶ and an accelerated rate of retirement among experienced cardiac surgeons.⁷ Some of these factors contributed to the conclusions of a Society of Thoracic Surgeons/American Association for Thoracic Surgery–commissioned Association of American Medical Colleges study that projected the demand for cardiothoracic surgeons could increase by as much as 46% by the year 2025.⁶ The trend toward a reduced number of residency programs and residents in training combined with an increased demand for experienced cardiothoracic surgeons

portends significant, perhaps critical, shortages in the future.

In response to the decline in applicants to cardiothoracic surgical residencies, the advent of multidisciplinary approaches for the treatment of cardiovascular and pulmonary disease, and perhaps inspiration from other highly competitive surgical subspecialties, prominent educators partnered with the American Board of Thoracic Surgeons and Thoracic Surgery Residency Review Committee to redesign the cardiothoracic surgical curriculum.⁸ Emphasis was placed on integrating formalized rotational experiences in medical and surgical subspecialties directly relevant to modern cardiothoracic surgical practice (eg, interventional cardiology/radiology, heart failure, critical care, cardiac anesthesia, vascular surgery) with traditional rotations in adult cardiac, congenital cardiac, general thoracic, and general surgery. In acknowledgment of the disadvantages of the 7- to 10-year duration of traditional cardiothoracic surgical training pathways, this new “integrated” curriculum was focused into a 6-year format.

Because the first integrated 6-year (I-6) program adopted at Stanford University in 2007 has recently graduated their first residents and the number of I-6 programs has steadily increased since its implementation, we thought it both timely and important to better understand the motivations,

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Abbreviations and Acronyms

ACGME = Accreditation Council for Graduate
Medical Education

I-6 = integrated 6-year

PGY = postgraduate year

satisfaction, and ambitions of I-6 residents. We therefore conducted a nationwide survey of I-6 residents in all US Accreditation Council for Graduate Medical Education (ACGME)-accredited I-6 programs and report our results and interpretations.

METHODS

A web-based electronic survey platform (Qualtrics, Provo, Utah) was distributed to all 83 residents enrolled in 21 ACGME-accredited I-6 cardiothoracic surgical training programs on November 1, 2013; the survey was closed on December 1, 2013 (Table 1). Four newly accredited I-6 programs had not yet enrolled their first residents at the time of this survey and were not included. A \$50 generic gift-card incentive for completed surveys was offered, and 2 reminder electronic mails for initial nonrespondents were sent. The anonymity of all respondents was preserved. Survey data were exported from the platform in a pure text file format (.CSV) and subjected to basic statistical analysis. An audit of the data revealed neither duplicate responses nor multiple responses from any one individual.

The survey was composed of 63 questions specifically designed to define the demographics, background/prior experience, motivations, satisfaction, and future career plans of current I-6 residents. Of these questions, 32 were multiple-choice with 3 permitting the selection of more than 1 choice and 25 questions were based on a Likert response scale. One question had fields for specific numeric responses. Two questions permitted free text responses. The Yale University Institutional Review Board approved the conduct of this study.

Only data from completed surveys were analyzed. GraphPad Prism software, version 6.0c (GraphPad Software, Inc, La Jolla, Calif) was used for basic statistical analysis and plotting of the data. Responses were computed and presented as frequencies. Free-text responses were qualitatively interpreted and categorized. Because there was no true control group, results were analyzed and presented in a descriptive manner.

RESULTS**Respondents' Demographics**

In November 2013, there were 21 ACGME-accredited I-6 cardiothoracic surgical residency programs with 1 to 12 residents each. A 69% response rate was achieved, with 57 residents from 19 programs completing the survey (Table 1). Of the respondents, 13 (23%) were women and 44 (77%) were men with a median age of 29 years. The representation of each of the 6 training years was as follows: postgraduate year (PGY)1 (37%), PGY2 (19%), PGY3 (21%), PGY4 (14%), PGY5 (5%), and PGY6 (4%).

Of those surveyed, 89% concomitantly applied to both general surgery and I-6 residency programs. Some of the respondents earned additional degrees during their education: PhD (9%), MPH (4%), and MSc (14%).

Many residents actively engaged in research before entering I-6 training (72%); most of their research was based in cardiovascular disease (68%).

Exposure to Cardiothoracic Surgery Before Matriculation

Of the 57 respondents, 93% rotated onto a cardiothoracic surgery clerkship during medical school with more than 63% spending 3 or more months on the rotation (Table 2). Approximately half observed (53%) or actively participated in (47%) more than 50 cases.

Career and Integrated Training Motivation

Previous clinical exposure, an interest in cardiovascular medicine, and mentorship were the most important factors in pursuing a career in cardiothoracic surgery for the majority of respondents (98%, 96%, and 89%, respectively) (Table 2). Of the factors measured, financial compensation was the least important consideration in entering the field, with 43.9% indicating that it was not important in their decision; salary level perceptions appeared to be slightly below published estimates.⁹ Furthermore, 60% of respondents were not motivated by earlier earning potential in applying to I-6 programs.

Of note, the I-6 format itself was a significant draw toward the field in 46% of the respondents. All of the respondents indicated that the focused curriculum of the I-6 format was the most attractive feature. Other desirable features of the I-6 training pathway included exposure to cardiovascular medicine (82%) and pulmonary medicine (60%), and the reduced general surgical rotational requirements (81%).

Satisfaction With and Prevalence of I-6 Program Curricular Elements

I-6 residents were "satisfied" or "very satisfied" with their cardiothoracic training (95%) (Table 3). In fact, if given a second opportunity to choose a residency program, 93% would again select an I-6 program; 2 respondents indicated that they would pursue a nonintegrated training pathway, and 2 others would pursue a different specialty altogether.

Several features common to I-6 curricula correspond to the overwhelming satisfaction with the I-6 format. Among the respondents surveyed, 81% were satisfied with their operative experience thus far (Table 3), because 23%, 31%, and 46% of respondents anticipated performing more than 200 cardiac cases by the end of their fourth, fifth, and sixth years, respectively (Figure 1). Lower general thoracic case numbers were noted; 19%, 17%, and 17% of respondents anticipated performing more than 200 cases over the same years. Dedicated time for didactic teaching and conferences appears to be emphasized in I-6 curricula, because 96% of respondents verified this educational component, with 87% of these residents receiving at least 2 hours of teaching per week. Technical

TABLE 1. General survey information and demographics

Parameter	
ACGME-approved I-6 residency programs in 2013	25
ACGME-approved I-6 residency programs with currently enrolled residents	21
ACGME-approved I-6 residency programs with survey respondents	19
No. of survey respondents	57
Survey response rate	69%
Survey respondent demographics	
Men	77% (n = 44)
Women	23% (n = 13)
Median age (y)	29
PGY distribution	
PGY1	37% (n = 20)
PGY2	19% (n = 10)
PGY3	21% (n = 13)
PGY4	14% (n = 8)
PGY5	5% (n = 4)
PGY6	4% (n = 2)
Survey respondent breakdown by program	
Integrated program	Respondents (n)
Cleveland Clinic	2
Emory University	3
Indiana University	2
Medical College of Wisconsin	3
Medical University of South Carolina	2
Mount Sinai School of Medicine	4
New York Presbyterian (Columbia)	DNP
Northwestern University	3
Stanford University	7
University of California Davis	0
University of Kentucky	1
University of Maryland	3
University of Michigan	2
University of North Carolina at Chapel Hill	5
University of Pennsylvania	4
University of Pittsburgh Medical Center	2
University of Rochester	2
University of Southern California	3
University of Texas Health Science Center at San Antonio	5
University of Virginia	1
University of Washington	3

Data are presented as percentage of 57 total respondents (%) or absolute number (n). ACGME, Accreditation Council for Graduate Medical Education; DNP, did not participate; I-6, integrated 6-year; PGY, postgraduate year.

training by faculty or advanced fellows outside of the operating room and simulation systems for cardiothoracic surgical or interventional procedures were available to 72% and 91% of respondents, respectively. Finally, faculty mentorship during training was acknowledged by 95% of respondents.

Despite overall satisfaction with the I-6 format, more operative exposure (58%), more didactic teaching (42%), and

TABLE 2. Motivations for pursuing a career in cardiothoracic surgery and integrated 6-year training

Exposure to cardiothoracic surgery in medical school	
Cardiothoracic surgical rotations	93%
Time on rotations	
None	7%
1 mo	12%
2 mo	18%
3 mo	32%
≥4 mo	32%
Active participation in cases	
0-10 cases	16%
11-50 cases	37%
>50 cases	47%
Factors influencing decision to pursue cardiothoracic surgical career	
Prior clinical exposure	98%
Interest in cardiovascular disease	96%
Faculty mentorship	89%
Patient characteristics	79%
New technologies	72%
Prior research in the field	63%
Income potential/future earnings	44%
I-6 format itself	46%
Factors influencing decision to pursue I-6 training	
Focused curriculum	100%
Integration of cardiovascular medicine	82%
Less general surgical training	81%
Shorter time in training	74%
Integration of pulmonary medicine	60%
Research opportunities	53%
Earlier income potential	40%

Data are presented as percentage of 57 total respondents (%). I-6, Integrated 6-year.

more elective rotations (37%) were programmatic changes most frequently identified by the surveyed residents (Table 3).

Future Career Plans and Outlook

Among the respondents, career plans skewed toward adult cardiac (67%), followed by pediatric cardiac (24%) and general thoracic (9%) surgery, with 93% anticipating an academic career (Table 4). Clinical or basic research activity was anticipated in 68% and 23% of the respondents, respectively, and many aspired to become a Division or Section Chief (61%). Of note, 78% of respondents devoted some time to conducting research during their training thus far, mainly in the domain of cardiovascular disease (68%). Although only 23% of respondents were afforded dedicated research time during their training, 63% of those surveyed engaged in research for more than 6 months.

Despite the higher perceived salary ranges relative to academic practice, only 26% of respondents anticipated pursuing a private practice career. Most I-6 residents (88%) planned to pursue additional subspecialty fellowship training (eg, aortic, heart failure, minimally invasive, congenital) after completing their programs. All surveyed residents believe that formal training in cardiac

TABLE 3. Satisfaction with and prevalence of integrated 6-year program curricular elements

Satisfaction	
Satisfaction with I-6 program	
Very satisfied	57%
Satisfied	38%
Neutral	5%
Dissatisfied	0%
Very dissatisfied	0%
If given another chance...	
Would still pursue I-6 training	93%
Would pursue traditional cardiothoracic training program	4%
Select another field	4%
Satisfaction with overall operative experience	81%
Prevalence of I-6 curricular elements	
Participation in research	
Engaged in any research during training?	71%
Dedicated research time?	23%
Time devoted to conducting research?	
<6 mo	38%
6-12 mo	23%
>12 mo	40%
Cardiovascular research?	68%
Training	
Didactic training?	96%
1 h/wk	13%
2 h/wk	58%
>3 h/wk	29%
>6 h/wk	0%
Technical training with faculty/fellow?	72%
Exposure to surgical simulation?	95%
Clinical proficiency appropriate at current training level?	67%
Suggested programmatic improvements?	
More operative experience	58%
More didactic teaching	42%
More elective rotations	37%
More nonoperative rotations	19%
More intensive care unit rotations	19%
More general surgical rotations	7%
Formal training in cardiac catheterization	100%

Data are presented as percentage of 57 total respondents (%). I-6, Integrated 6-year.

catheterization should be incorporated into the I-6 curricula, with 91% foreseeing that cardiothoracic surgeons will eventually perform catheter-based procedures.

With respect to career opportunities after graduating, 49% of respondents were not particularly concerned about future employment and thought that I-6 program graduates had a distinct advantage over traditionally trained graduates in the job market. In fact, 65% foresaw an increase in placement opportunities on graduation.

DISCUSSION

Over the 6 years that have passed since the adoption of the I-6 format at Stanford in 2007, a picture of the

characteristics and consequences of this nascent training paradigm is just now coming into sharper focus. The overarching goals of this new training strategy were (1) to develop a more focused and relevant curriculum to produce cardiothoracic surgeons better equipped to practice modern cardiothoracic surgery and (2) to attract a greater number of highly qualified trainees to the field.

Although the realization of these goals has yet to be definitively established, early indicators are promising. Since the initial adoption of the I-6 format, there has been a steady growth in the number of ACGME-approved I-6 programs in the United States, with 14 programs offered in the 2011-2012 match¹⁰ and 23 programs in the 2013-2014 match. Acceptance into these programs has been highly competitive, with more than 100 applications received by most programs for 1 or 2 positions each year. Furthermore, there is evidence indicating that the qualifications of the I-6 applicants are generally superior to those of applicants to traditional cardiothoracic surgical training programs. Chikwe and colleagues¹¹ at Mt Sinai Medical Center in New York and Gasparri and colleagues¹² at the Medical College of Wisconsin reported higher numbers of peer-reviewed publications and higher US Medical Licensing Examination scores among applicants for their I-6 program compared with their traditional program applicants. Although these parameters are not firmly established indicators for success as a surgical resident, they reflect positively on the assimilation and retention of curriculum and interest in research.

Conversely, some concerns about the I-6 format have arisen, including a perception that these programs are cardiac focused, uncertainty as to the willingness of cardiothoracic surgical faculty to train junior residents (particularly in the operating room), heterogeneity of the curriculum among different programs, vulnerability to midcourse resident attrition, and concerns related to the lack of maturity and clinical acumen otherwise obtained in traditional 5-year general surgical training programs.^{10,12} Indeed, the “direct-entry” integrated cardiac surgical residencies established in Canada in the early 1990s faced and continue to grapple with challenges similar to those currently faced with the US programs. The direct-entry general thoracic surgical programs did not succeed because graduates from these programs were only certified to perform general thoracic surgery; residents preferred to also complete general surgical training to provide them with more employment opportunities. In Canada, a significant proportion of general thoracic cases are performed by general surgeons, putting direct-entry thoracic graduates at a competitive disadvantage. Although these circumstances do not exist in the United States to the same degree, maintaining balance in US integrated program curricula and emphasizing rotational experiences relevant to general thoracic surgery would seem to be prudent.

FIGURE 1. The I-6 residents' anticipated cardiac and general thoracic case volumes per PGY. Data represented as percentages of 57 total respondents. PGY, Postgraduate year.

In acknowledgment of the perceived advantages and disadvantages of the I-6 format, the success or failure of this format will largely depend on the satisfaction of its participants, including their impressions of the quality of training provided and their desired and achieved career paths. In an effort to provide a snapshot of these objectives at an early stage of the format's evolution, we conducted a nationwide survey of I-6 residents and interpreted them according to the following domains.

Resident Characteristics

The survey data confirm the critical importance of substantial and sustained experiential exposure to cardiothoracic surgery and faculty mentorship in attracting medical students to the field of cardiothoracic surgery. It seems that the focused curriculum and format of I-6 programs were significant draws to the field in many respondents. We were particularly impressed that 26% of I-6 resident respondents earned additional advanced degrees (eg, PhD, MPH, MSc) and that 70% actively engaged in cardiovascular research before entering the residency. These characteristics, coupled with an overwhelming 95% of respondents intending to pursue an academic career, indicate an academic phenotype among

I-6 applicants. Whether this characteristic endures over the ensuing 6 years of training remains to be seen.

Satisfaction With the Integrated 6-Year Format

We observed that 95% of surveyed I-6 residents were "satisfied" or "highly satisfied" with their programs and that 93% would not have chosen an alternative pathway if given the chance. Several features stood out in detailing this overall satisfaction. As expected, the focused curriculum, exposure to cardiovascular and pulmonary medicine, and reduced time spent on general surgical rotations were seen as the most important advantages of the I-6 format among the respondents. Of note, 81% of respondents were satisfied with their operative experience thus far, with substantial proportions of the PGY4, PGY5, and PGY6 residents anticipating performing more than 200 cardiac cases by the end of their respective years of training. Substantial dedicated time for didactic teaching seems to be uniform among I-6 programs, with the majority of trainees receiving 2 or more hours of didactic teaching per week and faculty- or fellow-mediated technical training outside of the operating room. Training with simulator systems in cardiothoracic surgery or interventional cardiology appears to be de rigueur among I-6 programs.

TABLE 4. Future career plans and outlook

Anticipated practice after graduation?	
Adult cardiac surgery	67%
Congenital cardiac surgery	24%
General thoracic surgery	9%
Academic practice	95%
Private practice	26%
Plans to pursue additional training after graduation (eg, fellowship)?	
Congenital cardiac surgery	26%
Cardiopulmonary transplantation	17%
Minimally-invasive cardiothoracic surgery	15%
Thoracic aortic surgery	15%
Mechanical circulatory support	13%
Critical care	2%
Unsure	11%
Career outlook concerns?	
Not at all	9%
Slightly	40%
Moderately	32%
Strongly	14%
Very strongly	5%
Career placement opportunities in future...	
Will increase	65%
Will decrease	28%
Will remain the same	7%
I-6 training provides distinct advantages in job market?	49%

Data are presented as percentage of 57 total respondents (%). I-6, Integrated 6-year.

Finally, the fact that faculty mentorship was acknowledged by 95% of respondents should be reassuring to those that harbor concerns about faculty dedication to I-6 residents.

The respondents identified several areas of improvement. More operative exposure (58%), more didactic teaching (42%), and more elective rotations (37%) were the programmatic changes most frequently mentioned. Indeed, the integration of cardiovascular and pulmonary medical rotations was viewed as a valuable feature of their respective programs.

Our observation that most I-6 residents planned to pursue additional subspecialty fellowship training (eg, aortic, heart failure, minimally invasive, congenital) after graduating was not surprising, because this has also been observed with traditional cardiothoracic training programs. It is also not surprising that most surveyed residents believe that formal training in cardiac catheterization should be incorporated into I-6 curricula, with almost all anticipating that cardiothoracic surgeons will eventually perform catheter-based procedures. Certainly, an increasing number of cardiothoracic surgical residents are being introduced to catheter-based procedures, including thoracic endovascular aortic repair and transcatheter aortic valve replacement.

Cardiac Bias in Integrated 6-Year Programs?

Although the general thoracic operative case numbers were lower across all PGY categories, this did not translate

into dissatisfaction with the programs among the respondents. Nevertheless, the fact that only 9% of surveyed residents envisioned a career in general thoracic surgery compared with careers in adult (67%) and pediatric (24%) cardiac surgery is noteworthy. These observations are relevant to the perception that many I-6 programs are considered to be cardiac focused, despite conflicting evidence. Tchantchaleishvili and colleagues¹³ reported less interest in a thoracic surgery track among I-6 program applicants, but hypothesized that individuals interested in general thoracic surgery were self-selecting out of the I-6 match to train in general thoracic surgery programs and pathways. Ward and colleagues¹⁰ found that I-6 residents spend less time on general thoracic rotations than dedicated 3-year general thoracic pathways, but actually more than in traditional cardiothoracic training programs. Whether or not I-6 programs are truly “cardiac-centric,” it appears that they face competition from other training pathways in general thoracic surgery.

Career Outlook

The degree to which career plans of I-6 residents were skewed toward adult and pediatric cardiac surgery was surprising, particularly with renewed interest in general thoracic surgery among applicants to traditional cardiothoracic surgical training programs. There are several potential explanations. First, it is possible that medical students are not afforded as much clinical exposure to general thoracic surgery as general surgical residents. Second, the perception that I-6 programs are more cardiac focused may dissuade applicants interested in pursuing a career in general thoracic surgery, particularly with alternatives including 2- and 3-year “thoracic-track” programs. Finally, it is not unreasonable to consider that medical students applying to I-6 programs may naively and superficially view cardiac surgery as more “glamorous” than general thoracic surgery.

As mentioned earlier, our survey indicates an early preference toward academic careers, with 91% of respondents anticipating conducting research in their careers and a majority aspiring to academic leadership. However, given the limited numbers of I-6 programs affording dedicated research time to their trainees, it is questionable whether the interest, aptitude, and skills required to develop into a successful academician can be consistently developed in I-6 residents, particularly with the escalating challenges in acquiring extramural research funding.

We were struck by the general optimism among I-6 residents in terms of career placement opportunities, with approximately half of those surveyed not particularly concerned about finding a suitable position on graduation and a clear majority foreseeing an increase in future job opportunities. In fact, approximately half of our respondents thought that graduating from an I-6 program would

constitute a competitive advantage over graduates from traditional programs. It is worth mentioning that, among our respondents, the level of financial compensation did not appear to be a major consideration in making career choices; this finding is even more significant given that residents' perceptions of opening salary levels were below those of recently published estimates. Only 26% of respondents anticipated pursuing a private practice career, despite a higher perceived income compared with academic careers.

Study Limitations

Although we achieved an excellent 69% response rate and robust sample size given the relatively small numbers of I-6 residents and programs, we recognize several significant limitations of our survey. First, given that the first I-6 residents graduated earlier this year, our survey sample was heavily skewed toward trainees in their first 3 PGYs. Although we presume that the initial motivations for pursuing careers in cardiothoracic surgery and applying to I-6 programs would be definitive regardless of the point in training, the impressions gleaned from our survey may not hold steady as the junior residents progress through their training. Second, it is possible that respondents were biased toward residents who were pleased with their I-6 programs. Because we could not achieve a 100% response rate, eliminating the chances of such behavioral bias was not possible. Third, except for operative case volumes, we did not stratify the responses according to PGY because the differences in sample sizes between the different strata were too significant to make meaningful comparisons between individual years. Consequently, we were not able to ascertain variance in opinions among residents in the different stages in training. Third, the paucity of PGY6 residents to survey limits our ability to gauge the success of the I-6 format in developing confident, well-rounded cardiothoracic surgical residents who attain early career success and satisfaction. It would be important for future surveys to determine whether the strong preference toward academic careers reflected in this survey is actually realized among I-6 graduates. Finally, although we do not think that our modest monetary incentive to participate in our detailed survey was a confounding factor, it is conceivable that this skewed our sampling in some unforeseen way. We thought that increasing the likelihood of a robust survey response in the interest of arriving at truly representative conclusions outweighed any theoretic bias.

Many of the responses prompted additional questions that we would have liked to have posed. For example, given that an overwhelming majority of surveyed residents enjoyed faculty mentorship, it would have been useful to determine whether this was facilitated by the 6-year format versus traditional 2- or 3-year pathways. Furthermore, given the surprisingly low proportion of I-6 residents intending to

pursue a career in general thoracic surgery, additional questions designed to ascertain why would have been illuminating.

CONCLUSIONS

This survey takes an important snapshot of the nascent I-6 format, providing insight in determining (1) whether this format is achieving its overarching mission of attracting more highly qualified trainees to the field and producing surgeons well versed in contemporary cardiothoracic surgery, (2) whether current residents are satisfied with their quality of training, and (3) what features of currently heterogeneous I-6 residency curricula are most effective in achieving the desired goals. We confirmed that early mentorship and intense clinical exposure are critical in attracting applicants to the field and that the purported advantages of the I-6 format are currently holding true among I-6 residents, with a high level of satisfaction. Furthermore, these early data indicate that the I-6 format is a "work-in-progress" but holds significant promise in attracting, retaining, and producing highly qualified cardiothoracic surgeons.

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