Six-year integrated cardiothoracic surgery residency applicants: Characteristics, expectations, and concerns

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Objective: During the past 5 years, 6-year integrated cardiothoracic surgery residency programs have increased in number and popularity.

Methods: To understand the background and motivation of the applicants for 6-year integrated programs, we surveyed 80 candidates interviewing for Accreditation Council for Graduate Medical Education-accredited 6-year integrated cardiothoracic surgery residency programs for the 2012 match season, with 36 respondents completing the survey.

Results: The applicants interviewed for 6-year integrated programs had peer-reviewed publications (91.7%) and were interested in academic careers (91.4%), dedicated research time (58.3%), and cardiac surgery (66.7%). The time saved in training was considered an advantage of the 6-year integrated cardiothoracic surgery residency programs, although concern was present about the development of the mature, well-rounded cardiothoracic surgeon.

Conclusions: We found that most of the candidates for 6-year integrated cardiothoracic surgery residency were young, high-achieving individuals oriented toward academic careers with a significant interest in dedicated research time and cardiac surgery. (J Thorac Cardiovasc Surg 2013;146:753-8)

Because of declining number of applicants to traditional cardiothoracic (CT) surgery residency programs during the past decade,¹ 6-year integrated CT surgery (CT I-6) residency programs were approved by the Thoracic Surgery Residency Review Committee in 2007. The applicant pool for I-6 CT positions has increased in number, making such programs among the most competitive surgical residencies. To gain more insight into the background and motivation of the applicants for CT I-6 surgery programs, we surveyed 80 candidates who were interviewing for Accreditation Council for Graduate Medical Education (ACGME)-accredited CT I-6 residency positions for the 2012 match season.

METHODS

An online electronic survey was created in Google Docs (Google Inc, Mountain View, Calif), and the program coordinators of 15 ACGME-accredited CT I-6 programs participating in the 2012 residency match were asked to forward the survey to the candidates they selected for an interview and to provide us with the specific number of selected candidates. Because many candidates were interviewing for multiple I-6 programs, the respondents were asked not to complete the survey more than once. To preserve the anonymity of the applicants, the survey did not ask for names or Association of American Medical Colleges identifications. After

completing the survey, the data were exported in a pure text file format (.CSV) and subjected to statistical analysis. On review of the data, no similar entries were encountered, eliminating the possibility that any of the applicants had responded more than once.

The survey contained 17 questions. Of these, 10 questions provided 2 to 4 answers, of which only 1 answer could be selected, and 1 question allowed the selection of >1 answer, given the specifics of this question—types of residency programs applied to other than integrated CT surgery. Four questions had fields for specific numeric responses. To allow respondents to “open up” regarding the perceived advantages and disadvantages of the CT I-6 programs and provide comments on issues of which we were potentially unaware, the final 2 questions of the survey had free-text fields for open-ended responses. A copy of the actual survey can be found in the online Appendix. The research subjects review board of the University of Rochester provided an exemption for the present study.

R software, version 2.12.1 (R Foundation for Statistical Computing, Vienna, Austria), was used for statistical analysis and data visualization. The Shapiro-Wilk test was used to evaluate the skewness of the data. The mean $\pm$ standard deviation was used whenever the normality criteria were met. The median and interquartile range were used when the data were significantly ($P < .05$) skewed. The absence of a response was not considered a negative response, and the rules of missing data were applied to all calculations. The results of the calculations were rounded to a single decimal for simplicity. Both absolute numbers and percentages were provided for clarity. Free-text responses were qualitatively analyzed without using the statistical program and were independently consolidated into specific categories by the 2 investigators. Responses addressing >1 issue were consolidated into multiple categories. With consensus between the 2 of us, the responses in each category were counted and quantitative tables created.

RESULTS

General Information

As of December 2011, 15 of the 17 ACGME CT I-6 residency programs were participating in the 2012 residency match, and 18 first-year positions were available

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Abbreviations and Acronyms

ACGME	= Accreditation Council for Graduate Medical Education
CT	= cardiothoracic
CT I-6	= 6-year integrated CT surgery

(Table 1). The candidates invited for interviews by all 15 programs were surveyed from November 2011 to February 2012. On average, 21.6 ± 9.6 candidates were invited per program and 19.1 ± 8.6 were invited per residency position with a total of 80 I-6 applicants,² participating in the main residency match. The survey was completed by 36 applicants, for an estimated response rate of 45%.

Demographics

Of the 36 applicants, 11 (31.5%) were women and 25 (69.5%) were men (Table 2). The median age of the applicants was 27 years (interquartile range, 25-28). All respondents had applied to general surgery residency programs, in addition to the I-6 programs. Two candidates (5.6%) had also applied to integrated vascular surgery residency programs. No respondent had applied to other surgical subspecialties or nonsurgical residency programs. The mean reported United States Medical Licensing Examination score was 235.7 ± 15.7 and 246.7 ± 19.5 for steps 1 and 2 CK (Clinical Knowledge), respectively.

Interest in Academic Career and Research

Of the 35 respondents, 32 (91.4%) were interested in academic careers, and 3 (8.6%) were not sure (1 respondent did not answer this question) (Table 3). No respondent reported an interest in private practice. Of the 36 candidates, 33 (91.7%) had ≥ 1 peer-reviewed publication, and 3 (8.3%) did not. The median number of peer-reviewed publications at the survey was 3 (interquartile range, 1-6).

Also, 21 candidates (58.3%) expressed an interest in dedicated research time during their residency, 5 (13.9%) were not interested, and 10 (27.8%) were not sure. Of those interested in dedicated research, 16 (66.7%) wished to take 2 years off, 7 (29.2%) wished to take 1 year off, and 1 respondent (4.2%) would prefer to do research for >3 years.

Interest in Specific Tracks or Specialty

A total of 24 respondents (66.7%) were interested in the cardiac track only, 8 (22.2%) were interested in both cardiac and thoracic tracks, and 4 (11.1%) were undecided (Figure 1 and Table 3).

The decision to pursue a career in CT surgery was made by 10 respondents (27.8%) before entering medical school, by 8 (22.2%) during the first 2 years of medical school, by 12 (33.3%) during the third year of medical school, and by 6 (16.7%) during the fourth year of medical school.

Interest in Specific Types of Training

Comparing 3 different American Board of Thoracic Surgery pathways for becoming a CT surgeon, 30 respondents (83.3%) favored CT I-6 programs, 4 (11.1%) preferred general surgery residency followed by traditional CT surgery programs, and 2 (5.6%) preferred an integrated vascular surgery residency followed by a traditional CT surgery residency (Table 3). Of the 36 respondents, 35 (97.2%) would be willing to pursue traditional training (general plus CT) to become CT surgeons if I-6 programs did not exist; 1 candidate (2.8%) was undecided. Finally, 21 candidates (58.3%) would favor a 7-year program for additional Board certification eligibility in vascular surgery, 11 (30.6%) were undecided, and 4 (11.1%) answered negatively.

Perceived Advantages and Disadvantages of I-6 Programs

The time saved in total years of training was considered an advantage of I-6 programs (34 candidates), with more experience in CT surgery (15 candidates), the perceived increased collaboration and training with colleagues in related fields (12 candidates), and a mentor-apprenticeship model (3 candidates) also considered important (Table 4).

However, concern for the development of a well-rounded CT surgeon (11 candidates), uncertainty in fellowship and employment markets (10 candidates), ineligibility for American Board of Surgery certification (7 candidates), questions regarding the ability of the CT faculty to teach junior residents (5 candidates), the lack of a "chief year" experience in general surgery (4 candidates), and uncertainty about attrition (3 candidates) were potential problems (Table 5).

DISCUSSION

Previous reports by individual programs noted that their I-6 applicants had better United States Medical Licensing Examination scores and were more academically accomplished than traditional CT surgery residency candidates applying to the same programs.^{3,4} We reasoned that these remarkable differences were a product of unique characteristics specific to the I-6 applicant pool. To understand the true interest and characteristics of applicants to I-6 CT surgery programs, we surveyed a cohort of applicants who were selected for an interview by ≥ 1 ACGME-accredited CT I-6 program. To the best of our knowledge, no previous attempt has been made to study this group at an entire applicant pool level. Because our purpose was purely descriptive, any comparison of I-6 candidates with candidates for general surgery residency or traditional CT surgery residency was intentionally avoided, because such a comparison would be inherently prone to systematic error, given the limits of the survey.

TABLE 1. General information

Variable	Value
Total number of ACGME-approved CT I-6 residency programs in 2012	17
Number of ACGME-approved CT I-6 residency programs participating in 2012 residency match season	15
Number of first-year residency positions offered through participating approved CT I-6 residency programs	18
Average number of candidates invited for an interview per program	21.6 ± 9.6
Average number of candidates invited for an interview per residency position	18 ± 8.8
Total number of respondents to the survey	36
Candidates in the main residency match who ranked ≥1 CT I-6 residency program	80
Survey response rate (%)	45

Data are presented as n or mean ± standard deviation. ACGME, Accreditation Council for Graduate Medical Education; CT I-6, 6-y integrated cardiothoracic surgery.

The candidates interviewing for I-6 programs were very oriented to academic careers, with most interested in dedicated research time during their residency. A similar trend has been encountered by integrated programs in other specialties such as vascular surgery.^{5,6} This inclination could be partially explained because both CT I-6 and integrated vascular surgery applicants have mainly been exposed to academic surgery. It is also important to remember that the surveyed candidates were those who had already passed the initial selection process. Less accomplished candidates who were not offered interviews might have had less interest in academic careers and research.

A significant finding of our survey was that the I-6 applicants showed less interest in a thoracic surgery track. It is possible that because many of the I-6 programs are considered to be cardiac focused, individuals interested in general thoracic surgery have been self-selecting out of the I-6 match to train in general surgery programs with more focus on general thoracic surgery. This difference emphasizes the importance of providing flexible options for I-6 residents during the initial years of training and

maintaining the traditional pathways for general surgery residents deciding to enter thoracic surgery training.

Another interesting finding was the significant interest in additional vascular surgery Board certification. Because I-6 CT residents are not eligible for general surgery Board certification, which many candidates viewed as a significant disadvantage, vascular surgery Board certification could partially counter the effect of the lost general surgery privileges. Additionally, many applicants recognize the importance of endovascular surgical skills for CT surgeons in the current employment market. In several other countries, CT surgery training and practice does include vascular surgery,^{7,8} and a combined training paradigm in CT and vascular surgery has also been suggested for the United States.⁹ In 2011, the ACGME approved the first 7-year integrated residency program consisting of 5 years of vascular surgery and 2 years of CT surgery training, leading to Board certification in both thoracic and vascular surgery.¹⁰

Although 34 of the 36 respondents (94.4%) considered the time saved in total years of training an advantage of I-6 programs, most still favored a 7-year program for the additional Board certification eligibility in vascular surgery (58.3%) and wished to take dedicated time off for research (58.3%). We believe these seemingly contradictory results can be explained by our finding that CT I-6 programs attract academically oriented applicants who are interested in cardiovascular surgery. To achieve similar qualifications (Board certification in thoracic and vascular surgery) through the traditional pathway would take the trainee 9 to 10 years of training, excluding time off for research (5 years of general surgery residency, 2 to 3 years of a traditional CT surgery residency, and 2 years of a traditional vascular surgery residency) instead of a total of 7 years in the survey question. For the same amount of research, the CT I-6 pathway would also be shorter than the traditional pathway, with or without additional vascular training. Double certification through the traditional pathway for general surgery and thoracic surgery can be achieved in 7 years—the same number of years that would be required to complete a CT I-6 residency with an additional vascular year. Again, we hypothesized that the cardiac-oriented applicants perceived more benefits from double certification in thoracic and vascular surgery than for thoracic and general surgery.

Despite the clear advantages perceived by the applicants, several concerns and reservations persisted regarding CT I-6 residency programs. The dedication of CT surgeons as educators for residents at the junior level remains to be proved, and the variety of I-6 program curricula remain experimental. These concerns by CT I-6 applicants could explain why some CT I-6 candidates ranked robust general surgery residency programs higher than I-6 programs. Of the 36 respondents, 4 favored the traditional pathway for

TABLE 2. Numeric variables obtained from survey

Question	Response	Responders (n)
Age (y)		36 (100)
Median	27	
Interquartile range	25-28	
USMLE score		
Step 1	235.7 ± 15.7	35 (97.2)
Step 2 CK	246.7 ± 19.5	30 (83.3)
Publications (n)		33 (91.7)
Median	3	
Interquartile range	1-6	

Data are presented as mean ± standard deviation, unless otherwise noted; data in parentheses are percentages. USMLE, United States Medical Licensing Examination; CK, clinical knowledge.

TABLE 3. Distribution of categorical variables obtained from survey

Question	Response	Responses (n)	Percentage of each response	Total responders (n)	Percentage of total responders
Track of interest	Cardiac	24	66.7	36	100
	Thoracic	0	0		
	Undecided	4	11.1		
	Both	8	22.2		
Time of decision	Before medical school	10	27.8	36	100
	During first 2 y of medical school	8	22.2		
	As third-year medical student	12	33.3		
	As fourth-year medical student	6	16.7		
Programs applied to in addition to CT I-6 programs*	General surgery residency programs	36	100	36	100
	Vascular surgery integrated residency programs	2	5.6		
	Other surgical subspecialty programs	0	0		
	Nonsurgical residency programs	0	0		
Preferred training path	Integrated CT surgery residency	30	83.3	36	100
	General surgery residency plus CT surgery fellowship	4	11.1		
	Integrated vascular surgery residency plus CT surgery fellowship	2	5.6		
Dedicated research time preferred	Yes	21	58.3	36	100
	No	5	13.9		
	Not sure	10	27.8		
Preferred time off for research†	1 y	7	29.2	24	66.7
	2 y	16	66.7		
	3 y	0	0		
	>3 y	1	4.2		
Additional vascular year preferred (with Board eligibility in vascular surgery)	Yes	21	58.3	36	100
	No	4	11.1		
	Not sure	11	30.6		
Interest in traditional pathway if no CT I-6 pathway	Yes	35	97.2	36	100
	No	0	0		
	Not sure	1	2.8		
Type of practice	Academic	32	91.4	35	97.2
	Private	0	0		
	Not sure	3	8.6		
Gender	Male	25	69.5	36	100
	Female	11	31.5		
Publications	Yes	33	91.7	36	100
	No	3	8.3		

Data in parentheses are percentages. CT, Cardiothoracic; I-6, integrated 6-year. *This question allowed the selection of >1 answer. †This question was only for applicants interested in dedicated research time, who answered so in the preceding question.

becoming a CT surgeon. However, it was impossible to determine whether these 4 individuals ultimately matched into CT I-6 or general surgical program because of the anonymity of the survey. For the same reason, it was impossible to determine how many of the 36 respondents actually matched into an I-6 program. Given that only 15 ACGME-accredited CT I-6 residency programs (with 18 positions total) participated in the match and positions were unfilled, at least 1/2 of the respondents did not match into an I-6 program.

During the revision of our report, the Joint Council on Thoracic Surgery Education published the results of the I-6 Year Program Analysis Committee Meeting, which included a survey of active CT I-6 residents.¹¹ Remarkably, the answers to open-ended questions on the advantages and disadvantages of CT I-6 programs were very similar to the answers in our survey (Tables 4 and 5). Of the 40 CT I-6 residents surveyed, 20 (50%) were in their first year of training and were from the same applicant pool as those who completed our survey. It appears

FIGURE 1. Interest in specific track or specialty.

that the perceived advantages and disadvantages of the CT I-6 programs remain the same after starting the residency.

Study Limitations

The sample size of the survey was small and was obtained during the interview season. Our data might have been affected by both factors. Specifically, the limited number of respondents might not accurately represent the beliefs of the whole cohort of applicants. It is also possible that the applicants’ perceptions about program interest could have affected their responses (eg, reported interest in research, academic vs private practice, and specific thoracic tracks), although the anonymity of the respondents was preserved by not requesting their names or Association of American Medical Colleges identifications.

In general, the response rates to surveys have been found to be decreasing year by year.¹² In addition, the response rates have been lower in industrialized nations.¹³ Both of these, to some degree, can be attributed to survey fatigue from oversurveying.¹⁴ Considering these factors, a 45% response rate for a survey of this type can be considered quite a good result.¹⁵ In fact, a Canadian National Physician Survey of 62,441 practicing physicians, 2627 second-year medical residents, and 9162 medical students had a total

TABLE 4. Analysis of free-text entries: Perceived advantages of CT I-6 programs

Comment	Responses (n)
Time saved in total years of training	34
More experience in CT surgery	15
Increased collaboration/training with colleagues in related fields	12
Mentorship/apprenticeship model	3
Total unique responses	64
Total responders	36

CT, Cardiothoracic.

TABLE 5. Analysis of free-text entries: Perceived disadvantages of CT I-6 programs

Comment	Responses (n)
Well-rounded development of CT surgeon	11
Uncertainty in employment and fellowship market	10
Inability to sit for general surgery boards	7
Willingness of CT faculty to teach junior residents	5
No “chief year” experience in general surgery	4
Little room to accommodate attrition	3
Decreased general surgery experience	3
Decreased critical care experience	3
Insufficient training in vascular surgery	2
Need to commit to CT surgery while still a medical student	2
Limited number of CT I-6 programs	1
CT I-6 programs designed more for cardiac and not thoracic surgery	1
Too much general surgery experience	1
Impossible to switch to a different surgical subspecialty	1
Lack of adequate or level-appropriate in-training examination in CT surgery	1
No built-in dedicated research time	1
Poor communication to applicants about deadlines	1
Unsure	1
Total unique responses	58
Total responders	36

CT, Cardiothoracic; I-6, integrated 6-year.

response rate of 31.64%, with even lower response rates for medical students (30.8%) and residents (27.9%).¹⁶ However, although the unbiasedness of the estimates cannot be assumed without a 100% response rate, a nonresponse rate has been found to be a poor predictor of the bias magnitudes, and a low response rate by itself does not necessarily increase the nonresponse errors.¹³

Our response rate of 45% was only an estimate, because some of the invited candidates might not have been interviewed, and some of the candidates who were interviewed might not have ranked the I-6 programs in the main residency match. This estimated response rate of about 1/2 is what we would expect from the applicant pool without tracking the responses of individual candidates. We intentionally elected not to track the individual responses because doing so would void the anonymity of the survey and might have led to a severe bias in the responses of the I-6 candidates.

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