Motivations and Demographics of I-6 and Traditional 5+2 Cardiothoracic Surgery Resident Applicants: Insights From an Academic Training Program

Thomas K. Varghese, Jr, MD, MS, Nahush A. Mokadam, MD, Edward D. Verrier, MD, Delloney Wallyce, BS, and Douglas E. Wood, MD

Division of Cardiothoracic Surgery, Department of Surgery, University of Washington, Seattle, Washington

Background. The introduction of the integrated 6-year cardiothoracic surgery residency (I-6) has changed the training paradigm for future cardiothoracic surgeons. Increased interest in these programs emphasizes the need for an understanding of the applicant pool and of their differences from the traditional trainee (5+2).

Methods. National trends (National Resident Matching Program data), objective (Electronic Residency Application Services documents, United States Medical Licensing Examination [USMLE] scores, transcripts) and subjective metrics (interviews, personal statements, and recommendation letters) were evaluated for invited applicants for I-6 and 5+2 positions in 2010, 2011, and 2012. Demographics and motivations for specialty selection were determined. Statistical analyses were performed with Student’s t test for continuous variables and Fisher’s exact test for categoric variables.

Results. The number of applicants completing the match for I-6 positions each year was as follows: 2010, 74 (49 United States [US]); 2011, 74 (53 US); 2012, 80 (59 US). The number completing the match for 5+2 positions was as follows: 2010, 93 (67 US); 2011, 87 (55 US); 2012, 90 (63 US). For I-6 positions we interviewed 9 candidates in 2010, 17 in 2011, and 16 in 2012; for the 5+2 program we interviewed 14 candidates in 2010, 17 in 2011, and 13 in 2012. Both groups had a similar percentage of female applicants, number of US medical graduates, additional degrees, and membership in Alpha Omega Alpha. The I-6 applicants were younger (mean age, 27.4 years), were less likely to take time off for research (43.5% vs 72.7%), were less published, and had higher surgery clinical honors and USMLE scores. The 5+2 applicants were less likely to have done a cardiothoracic medical school rotation and had done senior-level rotations on general thoracic during residency; yet, only 29.5% had done a senior level cardiac rotation. The most frequently cited motivation was a clinical encounter during a cardiothoracic rotation for both (94.9% I-6 applicants, 88.6% 5+2 applicants). The I-6 applicants had more interest in minimally invasive techniques. There were no differences in the influence of a mentor or a desire for an academic career.

Conclusions. Institutional strategies to increase medical student and general surgery resident exposure to cardiothoracic surgery clinically will optimize our ability to attract and train the best candidates in our specialty.

The first thoracic residency was established at Michigan by John Alexander in 1928. Originally a 1-year program, the residency was expanded to 2 years by 1932. Dr Alexander’s belief was that “less than 2 years of intensive training in a very active thoracic surgery clinic is insufficient…” and that “a greater length of time would be desirable” [1]. The training paradigm of prerequisite certification in general surgery before thoracic surgery residency continued until July 2003, when American Board of Surgery certification became optional [2].

Responding several changes in the educational environment, several pathways were approved for certification by the American Board of Thoracic Surgery (ABTS), including the traditional completion of a full residency in general surgery followed by at least a 2-year independent thoracic surgery residency (5+2) and a 6-year integrated thoracic surgery residency developed along guidelines established by the Thoracic Surgery Directors Association (TSDA) (I-6).

Given that these training pathways attract different populations of trainees into the specialty of thoracic surgery, we sought to review the demographics and responses of applicants to an I-6 program as compared with the traditional 5+2 program to gain insight into the applicants’ background and their motivation for accelerated or traditional training, and to assess the characteristics of the applicant pool.

Accepted for publication April 28, 2014.


Address correspondence to Dr Varghese, Division of Cardiothoracic Surgery, University of Washington, 325 Ninth Ave, Box 359796, Seattle, WA 98195-9796; e-mail: tkv@uw.edu.

© 2014 by The Society of Thoracic Surgeons
Published by Elsevier Inc
Material and Methods

As an early adopter of the I-6 program at our institution, we have participated in three match cycles from 2010 to 2012 while maintaining our traditional 5+2 pathway. One resident per year was recruited into the I-6 program during these years, and two were recruited into each of the 5+2 matches. Online public databases from 2010 to 2012 from the Electronic Residency Application Services (ERAS) and National Resident Matching Program (NRMP) web sites were queried to assess national trends [3, 4]. The number of applicants according to surgical subspecialty and medical school type was obtained from the ERAS database. The number of available programs and match participants were obtained from the NRMP online publications. All applicants invited to interview for the University of Washington I-6 and 5+2 programs were included in the analysis, inasmuch as this enabled direct questioning of applicants about their motivations for pursuing a thoracic surgery career. Information from ERAS documents, responses to interview questions, personal statements, and recommendation letters were collected prospectively into a de-identified database over the course of 3 years and then were retrospectively reviewed. The applicants’ demographics were collected from the ERAS program. Academic metrics assessed included core surgery clerkship grades, honors such as Alpha Omega Alpha (AOA) membership, class rank, and mean United States Medical Licensing Examination (USMLE) scores. Research productivity was evaluated, including dedicated time off for research, number of publications and presentations, and whether additional degrees were obtained (MS, MBA, MPH, or PhD). Motivations for pursuing a career in thoracic surgery were collected from information contained in the personal statements and by direct questioning during the interviews. The applicants’ demographics and motivations were then compared between groups. Statistical analyses were performed with Student’s t-test for continuous variables and Fisher’s exact test for categorical variables. Statistical significance was predetermined at an α of 0.05 (two-tailed), with a Bonferroni correction to account for multiple comparisons. STATA (Special Edition 9.2, Statacorp, College Station, TX) was used for all statistical analyses.

This study was approved by the University of Washington Institutional Review Board.

Results

Trends in Number of Applicants and Available Positions

The number of I-6 positions in the match increased from 10 positions in 2010 to 13 programs and 20 positions in 2012 (Fig 1). During the same period of time, the number of 5+2 positions decreased by 12% from 116 in 2010 to 102 in 2012, continuing a trend of decreasing number of thoracic surgery independent program positions [5]. In the I-6 match, the number of ERAS applicants exceeded the number of those who participated in the match as compared with the NRMP match applicants (171 total ERAS applicants in 2010, 192 in 2011, and 186 in 2012). The reasons for this discrepancy were not explored during the current study, but it does affect the number of applications that programs screen to arrange for interviews. To assess the relative competitiveness of the I-6 and 5+2 application process, the ratio of NRMP match participants to residency positions was calculated (Table 1). The I-6 programs had higher ratios (7.4 in 2010, 5.7 in 2011, and 4 in 2012) than did the 5+2 programs (0.8, 0.77, and 0.88 respectively). The I-6

Table 1. Competitiveness of I-6 and 5+2 Application Process 2010 to 2012

<table>
<thead>
<tr>
<th>Variable</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-6 Residency positions</td>
<td>10</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>I-6 NRMP participants</td>
<td>74</td>
<td>74</td>
<td>80</td>
</tr>
<tr>
<td>I-6 NRMP participant% US graduates</td>
<td>80.0%</td>
<td>92.3%</td>
<td>95.0%</td>
</tr>
<tr>
<td>I-6 Participant: position ratio</td>
<td>7.4</td>
<td>5.7</td>
<td>4</td>
</tr>
<tr>
<td>5+2 Residency positions</td>
<td>116</td>
<td>113</td>
<td>102</td>
</tr>
<tr>
<td>5+2 NRMP participants</td>
<td>93</td>
<td>99</td>
<td>80</td>
</tr>
<tr>
<td>5+2 NRMP participants % US graduates</td>
<td>52.6%</td>
<td>54.9%</td>
<td>53.9%</td>
</tr>
<tr>
<td>5+2 Participant: position ratio</td>
<td>0.8</td>
<td>0.87</td>
<td>0.78</td>
</tr>
<tr>
<td>I-6 positions filled in the match</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>5+2 positions filled in the match</td>
<td>72.4%</td>
<td>77.9%</td>
<td>76.5%</td>
</tr>
</tbody>
</table>

NMRP = National Resident Matching Program; US = United States.
programs matched higher percentages of medical graduates in the United States (US) and filled all of their positions in the match.

Demographics of Applicants

Nationwide, there was a higher number of ERAS applicants compared with those who remained in the match (Table 2). The University of Washington (UW) thoracic surgery residency program received a high number of applicants all 3 years for both I-6 and 5+2 programs (Table 3). The total pool of applicants for the I-6 program were younger (mean age, 26.9 years); had a higher percentage of female applicants, US medical graduates, and AOA membership; were less likely to take time off for research; had published less; and had higher USMLE scores. The total applicant pool did not differ in terms of surgery clinical honors and additional degrees.

Demographics of Interviewed Candidates

The UW thoracic surgery residency program interviewed 9 I-6 candidates in 2010, 17 in 2011, and 16 in 2012. For the 5+2 program there were 14, 17, and 13 candidates in the respective years. Both groups had similar percentages of female applicants, US medical graduates, additional degrees, and AOA membership. The I-6 applicants were younger (mean age, 27.4 years), were less likely to take time off for research (43.5% vs 72.7%), had published less, and had higher USMLE scores. The total applicant pool did not differ in terms of surgery clinical honors and additional degrees.

Factors Influencing Specialty Choice

A list of factors that motivated a candidate for a career choice was generated with help from a review of the literature [6-11]. The interviewed candidates were allowed to select from a list of factors influencing their choice of thoracic surgery as a career, and they were encouraged to select all factors that influenced their decision. Factors were additionally identified from personal statements and recommendation letters (Fig 2). The top three factors cited by both groups were clinical experience on a cardiothoracic surgery rotation, challenging open surgical operations, and desire to pursue an academic career with research opportunities. When looking further at when their first experience on a cardiothoracic rotation occurred, only 29% of 5+2 applicants had such an experience during medical school. During their general surgery residency, the 5+2 applicants all had senior-level rotations on general thoracic surgery, but only 29.5% had done a cardiac surgery rotation. The I-6 applicants had significantly more interest in minimally invasive operations and catheter-based techniques (51.3% I-6 vs 27.2% 5+2).

The 5+2 applicants were less likely to have done a cardiothoracic medical school rotation and had done senior-level rotations on general thoracic during residency; only 29.5% had done a senior-level cardiac rotation (Table 4). The most frequently cited motivation was a clinical encounter during a cardiothoracic rotation for both groups (94.9% I-6 applicants, 88.6% 5+2 applicants). The I-6 applicants had more interest in minimally invasive techniques, catheter-based procedures, and new technology. There were no differences in the influence of a mentor or a desire for an academic career. Neither group cited lifestyle factors and income potential as factors in choice of specialty.

Comment

The steady decline in the number of candidates for independent programs has been well documented: a 27.6%
decrease in the number of residency positions from 1999 to 2012, accompanied by a 52.3% reduction in the number of applicants [12]. Before the creation of multiple pathways toward ABTS certification, the entry point for trainees was limited to the general surgery residency program. However, the training environment in general surgery has considerably changed over the years [13]. The 80-hour work week has led to a reduction by almost a year of in-hospital experience for most surgical trainees, with the missed time leading to decreased involvement with urgent and emergent cases, less autonomy, and less independent functioning. The approval of alternative pathways to ABTS certification, including the integrated 6-year residency program, was one mechanism to counteract the trends of decreasing applicants and perceived change in quality of entering trainees [14], with the hope of continuing to attract the most qualified individuals to the field of thoracic surgery and lengthening the exposure to the specialty over the course of training.

Two prior studies have assessed the applicant pool for the integrated thoracic surgery residencies [5, 15]. The current study differed from these studies in that it looked at the demographics of the applicant pool for 3 years rather than 1 year, and it examined the reasons for choice of specialty. Our findings for demographics were similar to those of the prior studies. There were higher numbers of ERAS applicants than NRMP match participants in the

### Table 4. Demographics of Candidates Interviewed for I-6 and 5+2 Programs at University of Washington Between 2010 and 2012

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>I-6 (n = 39)</th>
<th>5+2 (n = 44)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y (mean ± SD)</td>
<td>27.3 ± 2.9</td>
<td>32.3 ± 2.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>33.3%</td>
<td>22.7%</td>
<td></td>
</tr>
<tr>
<td>US medical graduate</td>
<td>95.0%</td>
<td>84.1%</td>
<td></td>
</tr>
<tr>
<td>Additional degrees</td>
<td>28.2%</td>
<td>20.4%</td>
<td></td>
</tr>
<tr>
<td>AOA membership</td>
<td>43.6%</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>Surgery honors</td>
<td>84.6%</td>
<td>61.4%</td>
<td>0.02</td>
</tr>
<tr>
<td>Dedicated time off for research</td>
<td>43.5%</td>
<td>72.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of publications, mean ± SD (median)</td>
<td>2.92 ± 2.87 (2)</td>
<td>10.5 ± 12.3 (7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Exposure to CT surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical school rotations</td>
<td>100%</td>
<td>29.5%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>General surgery rotations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General thoracic</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult cardiac</td>
<td>29.5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AOA = Alpha Omega Alpha; CT = cardiothoracic; SD = standard deviation; US = United States.

Fig 2. Motivations of cardiothoracic (CT) surgery applicants for specialty choice. (CTV = cardiovascular thoracic.)
I-6 program. Traditional reasons for withdrawing from the match include failure to get interviews, inability to get visas for foreign medical graduates, and issues with medical school transcripts. The exact reasons for this discrepancy were beyond the scope of the current study, but the implication for programs with I-6 training pathways is the need to screen from a larger number of applications during the interview process. Academically, there were similarities in both groups, with similar percentages of additional degrees and AOA membership. The I-6 residents had a higher percentage of surgery clinical honors and USMLE scores, but because these reflect medical school performance, their utility in determining the quality of a 5+2 applicant may be of less value. Although nationally the percentages of US medical graduates in the match from 2010 to 2012 were less for the 5+2 than in the I-6 programs, we did not see a significant difference in the groups that were invited for interviews at our program.

When the motivations for choice of specialty were looked at, both groups cited similar factors. Experience during clinical rotations and the complex nature of open cardiothoracic surgical procedures had the greatest impact among our study population. This is similar to findings from other studies of surgical specialties in which the types of procedures and techniques performed drive career choices [16]. Less than a third of 5+2 applicants had cardiothoracic surgery rotations in medical school or any type of cardiac surgery experience during their general surgery residency. Many general surgical training programs shortened the duration of rotations or pulled residents from subspecialty fields in response to the mandate for restricted work hours. Studies have shown that about half of general surgery residents remain undecided about their choice of specialty through the third year of their training [16]. That percentage then quickly declines to about 5% at the fifth year of their training. With increasing numbers of graduates from general surgery programs seeking additional specialty training nationwide, clearly an opportunity exists to recruit them by improving the quality of the clinical rotation experience. Institutional strategies are thus needed to increase the exposure of general surgery residents to cardiothoracic surgery if we are to make any progress in rectifying this situation.

We did not examine the differences in desire for a cardiac, general thoracic, or congenital cardiac career among the groups in the current study because our residency program does not have separate tracks within the I-6 and 5+2 pathways. The I-6 applicants, however, cited interest in minimally invasive techniques and catheter-based skills more often than did those in the 5+2 group, and thus the difference in interest may lend to the belief that the majority of I-6 programs are intended for those interested in cardiac surgery careers. Although both groups had similar desires for an academic career, the 5+2 applicants were more likely to have taken time off for research and to have an increased number of publications. This may be a byproduct of applicants interviewing at an academic center. Future studies should track not only the quality of training but also the type of practice of graduates of these pathways.

This study has some limitations. It captures the motivations of applicants to a single thoracic residency program and hence possibly limits the generalizability of the findings. The rationale for restricting the analysis of motivations to only the interviewed applicants was related to the method of data capture, which was a combination of review of applicant files and personal interviews. Personal interviews of the entire applicant pool were beyond the scope of the current study. The findings of the present work should in no way be used as a possible prediction of future performance, because that information was beyond the scope of this study. Although older studies demonstrated that students who chose surgical specialties cited motivating factors other than controllable lifestyle issues [17, 18], recent studies have demonstrated that impact on lifestyle, such as unpredictable work hours and demands on time and effort, are of growing importance to the current generation [6]. The fact that no respondents picked lifestyle and income potential as motivating factors may be a product of other confounding variables such as a possible negative connotation associated with these choices if they are admitted to during the interview process.

In summary, determining what inspires a medical student or resident to choose a specialty is important information that program directors and educators can use as they try to recruit the best and the brightest candidates into their program and ensure a future stable workforce. Institutional strategies to increase the clinical exposure of medical students and general surgery residents to cardiothoracic surgery will optimize our ability to attract and train the best candidates. Further studies are needed to determine the impact of the different training pathways on the acquisition of skills and on outcomes. However, maintaining quality in training in both pathways can help in the recruitment of the broadest spectrum of the applicant pool into our specialty, and it can ensure the growth of our field in the years to come.

References

DISCUSSION

DR BENJAMIN KOZOWER (Charlottesville, VA): Excellent job with that presentation. Two questions for you. It’s amazing when you see that approximately only a third of the applicants actually end up in the match. So what are you going to do in the future to try and look at that? How could you actually look at that?

DR VARGHESE: Which match are you talking about, the I-6 or the 5+2, or both?

DR KOZOWER: It was the I-6, I think.

DR VARGHESE: Yes, it’s interesting. I mean, it was beyond the level of the scope. We don’t know if this is because there are a lot of, for example, a lot of foreign medical graduates who are trying to enter into the system; they want to train in cardiothoracic surgery, and hence the system gets overwhelmed with the number of applications. It’s a great question, but it is probably something that we should delve into further because we want to make sure that we have the ability to recruit anybody anywhere in the world for our highly competitive training programs as well.

DR KOZOWER: And then some of the comments that came up with the previous presentation you guys actually examined, which was, you know, general surgery programs don’t spend much time in cardiothoracic surgery anymore, but somehow these medical students when they get exposed are interested. So what have you guys done in Seattle to try and target the medical students?

DR VARGHESE: Well, it’s something of debate that we’re talking about. It’s interesting, Ara Vaporiyan actually, in 2010, did a survey that was conducted by the AAMC, approved by both the STS and the AATS. And the interesting finding of that survey was that 50% of general surgery residents at the end of their second year in training still are not sure what specialty they’re going to go into. So half the crowd is making these decisions midway between their residency. Everybody knows that in response to the 80-hour work week, they’ve pulled people off subspecialty rotations, decreasing exposure to that field. We say that the three principles of a successful surgical intervention are exposure, exposure, exposure. I think the same thing happens with career choice as well. That is, if you don’t get exposed to the field, it becomes difficult to choose that as a future career as well.

DR RICHARD FEINS (Chapel Hill, NC): Tom, that was very good, and I think it is critically important that we continue to critically look at what’s going on with the I-6 program. I can just about assure you that the differentiation of those applying versus those who actually enter the match has to do with a bias against international graduates. I think it really is incumbent upon the specialty to figure out ways of evaluating and opening up the doors to these individuals, because there are some fabulous international graduates out there that are not getting access to this specialty primarily because of the bias. In the early days of the I-6 there was even misinformation coming out that we weren’t allowed to take international graduates. My question, though, concerns the high percentage of I-6 applicants who want to go to academic medicine and the relative inability, as presently constructed, of the I-6 to provide research opportunities for them. And so I just wondered what you thought about that. And
the other part of this issue is that the ability to take time out of the residency and go into the laboratory for a couple of years can be a very good debt-reduction mechanism, and within the I-6, at present, that is going to be very difficult to do.

DR VARGHESE: Thanks, Dr Feins. It’s a similar question to both. That is a great question. I mean, we’ve anecdotally seen at our center that a large proportion of them are interested in pursuing research. Now, we do have the advantage that we have both programs robustly, and we can tell the candidates that if you do have a plan for research and it’s absolutely of educational value, we do have a little bit of luxury in terms of able to backfill in and take people in to make sure that we have two people graduating each and every single year. But it’s going to be interesting to see long term, even though people are expressing this interest: are the graduates of I-6 programs actually going into academic fields, or is there going to be a difference between the two groups? But it is something that we’ll have to track in the future as well.

DR JOHN CALHOON (San Antonio, TX): Dr Varghese, I very much enjoyed your presentation. Your presentation speaks to a point many see coming, that is, a need to remain competitive in the integrated program match. Soon, we’re going to have so many integrated programs that the number of great applicants will be so small that lesser applicants will begin to appear competitive. Similarly, the traditional program paradigm has had difficulty with having the number of applicants required to have excellent candidates for all openings. I think we’re going to have a number of pathways open for a good while to keep attracting and training very good residents. This ultimately supports the notion we need to develop “merit badges” developed after one acquires a solid surgical foundation. After obtaining the foundation, one could then pursue “merit badges” (Dr Curt Tribble is the person I attribute the coining of this term to) in any combination of thoracic, aortic, cardiac, or congenital? I just wondered if you might comment on that.

DR VARGHESE: The merit badge analogy—that’s a great question. I mean I think another way of spinning that, Dr Calhoon, is this. Even though some people feel that one is better than the other, I think there is a rationale for saying that we should, as a field, open up all the different pathways and make sure we maintain the highest quality in everything. Because that really opens it up to get the widest breadth of the applicant pool coming into our specialty. And I think that the mechanisms we do by doing that are great. Maybe there needs to be a look nationally about which programs should remain open and which shouldn’t. But from an educational perspective, I think having all the different options available is the best, and whether it’s a merit badge method or something else, I think time will tell.

DR MICHAEL ACKER (Philadelphia, PA): I had a comment along those lines, but two other comments came up. There is another person who dropped out, so our very first woman did drop out and did change residency career plans.

DR VARGHESE: So it’s two people. Okay, fair enough.

DR ACKER: The second comment is that our integrated program has a relatively mandatory 2-year research built in. So there is nothing unique to say the I-6 can’t be 8, just as any general surgery program that’s 5 can be 7. So you just have to have a funding mechanism. And finally, I just want to make a comment that I think it’s absolutely essential that we do not go to one pathway, I-6. I feel extremely strong about this. At Penn we have both, and we will continue to have both. It is a way of backfilling so you’re never caught short. Though your data suggest that the quality of the applicant may be less in the 5+2 pathway, the very highest—that would be interesting to see the standard deviation—because the top 10 in the 5+2 are still as good as they ever were; they just aren’t as many. And to eliminate that pathway for the guy that gets turned on in his fourth year, his third year in general surgery would be a big mistake. So I really liked your presentation. Thank you.

DR VARGHESE: Thanks, Dr Acker. We completely agree. I think maintaining both pathways makes sense, and really, that was sort of the take-home message from our work: we need to figure out some way of trying to increase that clinical exposure during general surgery programs as a way of counteracting this declining trend.

DR VASSYL LONCHYNA (Chicago, IL): I noted that 100% of your residents in the traditional field had exposure to thoracic surgery. Did you have any kind of breakdown whether those who had exposure to thoracic surgery then went on to the fellowship on a thoracic track versus the cardiac track?

DR VARGHESE: Great question. Two responses to that. We don’t have tracks in our training program, so we consider them undifferentiated at the beginning. We did not delve further into finding out what the quality of that exposure was. And so we didn’t go and delve down and see if it was a 1-month rotation on thoracic, 2-month, how many cases—we didn’t really go into those types of details, so those are responses to those questions.