Thoracic Surgical Resident Education:  
A Costly Endeavor

John H. Calhoon, MD, Clint Baisden, MD, Ben Holler, BA, George L. Hicks, MD,  
Ed L. Bove, MD, Cameron D. Wright, MD, Walter H. Merrill, MD, and  
Dave A. Fullerton, MD

Department of Cardiothoracic Surgery, University of Texas Health Science Center at San Antonio, San Antonio, Texas; Division of Cardiothoracic Surgery, University of Rochester, Rochester, New York; Department of Cardiac Surgery, University of Michigan, Ann Arbor, Ann Arbor, Michigan; Division of Thoracic Surgery, Massachusetts General Hospital, Boston, Massachusetts; Division of Cardiothoracic Surgery, University of Mississippi, Jackson, Mississippi; and Division of Cardiothoracic Surgery, University of Colorado, Denver, Colorado

Background. We sought to define an accurate measure of thoracic surgical education costs.

Methods. Program directors from six distinct and differently sized and geographically located thoracic surgical training programs used a common template to provide estimates of resident educational costs. These data were reviewed, clarifying questions or discrepancies when noted and using best estimates when exact data were unavailable. Subsequently, a composite of previously published cost-estimation products was used to capture accurate cost data. Data were then compiled and averaged to provide an accurate picture of all costs associated with thoracic surgical education.

Results. Before formal accounting was performed, the estimated average for all programs was approximately $250,000 per year per resident. However, when formal evaluations by the six programs were performed, the annual cost of resident education ranged from $330,000 to $667,000 per year per resident. The average cost of $483,000 per year was almost double the initial estimates. Variability was noted by region and size of program. Faculty teaching costs varied from $208,000 to $346,000 per year. Simulation costs ranged from $0 to $80,000 per year. Resident savings to program ranged from $0 to $135,000 per year and averaged $37,000 per year per resident.

Conclusions. Thoracic surgical education costs are considerably higher than initial estimates from program directors and probably represent an unappreciated source of financial burden for cardiothoracic surgical educational programs.

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There have been few reports on the cost of surgical education for residents. In addition, most have been quite limited in scope, with no uniform agreement on what factors should be included in calculating the real “cost” of surgical education [1–3]. For example, one study reported a 35% increase in operative time when residents participated in an operation, yet there was no recognition of this “lost” time to the surgeon [1]. Another study reported on direct costs borne by a department of surgery not paid for by Direct Medical Education and Indirect Medical Education funds, which totaled $153,000 per year [2]. In another report, instituting a modern curriculum was reported to cost $235,000 for one department of surgery [3]. There are no similar studies reporting the costs associated with thoracic surgery residents; therefore, the aim of this study was to better estimate thoracic surgical educational costs.

Material and Methods
After informal discussion amongst a number of the authors, we realized there had not been a formal effort to capture all of the costs involved in the education of thoracic surgical residents. Because the traditional paradigm of 2 to 3 years of education is evolving to allow for integrated as well as other innovative and more lengthy and time-consuming approaches to education, we determined that a closer look at all costs and benefits associated with thoracic surgical education would be valuable. Initial informal estimates for resident educational costs ranged from $150,000 to $250,000 per year, and most of the authors felt that the cost was closer to the higher value. The first author enlisted the support of previous collaborators to adapt a clinical trial cost-estimator tool for the purpose of capturing all costs and benefits of thoracic surgical education [4].

Authors Baisden, Holler, and Calhoon reviewed this tool and sent it to the other authors for their critical review and input. Once this tool was finalized, the authors...
enlisted the support of their respective program directors, administrators, and program coordinators to populate the spreadsheet. These spreadsheets were gathered and collected between mid-2011 and early 2012, and the data were carefully reviewed and scrutinized. In some cases, it was clear that costs could be assigned to overlapping areas. Where there was ambiguity in the data or a question of accurately assignment of costs, further discussion ensued. Once the data were felt to be valid and defensible, the data were compiled into a master data set to calculate averages and ranges. Deidentified data were subsequently sent to each author to ensure that each program was satisfied with its own data as well as the data set as a whole.

Results

Initial cost estimates were found to be fairly low. Not surprisingly, the highest cost was attributed to faculty time and effort. Of note, all programs spent a significant amount of time and money on Accreditation Council for Graduate Medical Education (ACGME) preparation, resident recruiting, simulation, and teaching conferences. Financial benefits associated with resident work efforts were real but not nearly as high as the costs associated with their education. An endowment had been created in one program to provide $100,000 annually to offset costs. The average benefit would have been somewhat lower without this fund.

The study programs enrolled between 1 and 3 residents per year and represented the spectrum of integrated as well as traditional 2-year and 3-year training paradigms. The costs are portrayed in a spreadsheet for clarity (Fig 1). The exact number of residents per year, total number of residents, and program length were omitted for confidentiality reasons.

Resident costs are dominated by the faculty time and effort spent in education, mentoring, and performing ACGME requirements. Significant costs are now incurred in training programs to ensure that quality efforts are continually made and documented. The oversight mandated by the ACGME is costly but has provided a framework that most authors believed provided significant protection for the resident and the program. The paperwork and documentation required to prepare for these visits is expensive and time consuming.

The use of simulation, an improved educational curriculum, and additional conference time have been

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**Fig 1. Resident cost-and-benefit worksheet. (ACGME = Accreditation Council for Graduate Medical Education; AVG = average; FTE = full-time equivalent; RRC = Residency Review Committee.)**
developed in an effort to enhance the educational efforts and to fill a void left by the fewer hours available at the bedside and in the operating rooms. In short, the operation of a successful resident educational effort has become a full-time business that requires a well orchestrated and focused team.

Comment
In all likelihood, there are additional costs associated with thoracic surgical education that this measurement tool was unable to capture. We stress that these were estimates from vastly different programs in different areas of the country. Programs varied by number of residents, clinical caseloads and volumes, and disparate curricula. In fact, some programs embraced simulation and others stressed research, thus incurring additional laboratory expenses. Physician extender support varied extensively among programs. Similarly, the number and scope of faculty in each program and their respective salaries and support were noted to have a wide range of values. We did not directly measure direct or indirect GME support to hospitals or to resident salaries, only what the facility or professional practice paid for the resident. As such, these data are only able to reflect a reasonable estimate of resident educational cost. The finding that programs did not realize a significant cost-benefit associated with resident participation in patient care was surprising but consistent among the programs participating in this study.

Nationally, the Centers for Medicare and Medicaid Services provide direct and indirect GME support for residency education, which now totals at least $13 billion per year. Direct GME support is primarily for resident salary and benefits as well as for GME offices in every educational site, including a designated institutional officer and staff in addition to other administrative costs. Thus, this study likely underestimated thoracic resident educational costs because we did not account in our data for the percentage of ACGME office support, administrative support, the cost of a sleep deprivation module, professionalism modules, or blood borne pathogen protection modules, in addition to other teaching modalities.

The indirect support is more difficult to clearly define and is not uniform across the country. Each state or region receives Centers for Medicare and Medicaid Services support for academic health centers that provides augmented reimbursement for the increased costs associated with educational programs, including regional cost modifiers. Further, many state Medicaid programs also provide similar increased payments to teaching hospitals to offset the costs associated with education. Interestingly, with state budgets coming under increasing financial pressure, many states have decreased or removed all such differential indirect payment support. In fact, 11 states offer no such support at all through Medicaid [5].

If one were to calculate the direct and indirect support GME provides nationally as a percentage of the additional support that GME programs actually accrue, the costs of education in medicine are likely to be much higher. Even if resident salaries and other GME-supported costs were only half of the actual educational support provided to hospitals, the actual annual projected costs of (all GME) physician resident education would likely be $25 billion or more.

The purpose of this study was to assess programmatic costs associated with thoracic surgical education. As this effort developed, however, it became clear that there are many questions still to be answered. Nonetheless, we believe that this project has made a reasonable estimate of the cost of education.

In conclusion, we hope that these data will be of use in coping with the difficult decisions looming regarding GME support and stimulate further efforts to study the needs and effects of thoracic surgical education. Although the education of thoracic surgical residents is costly, these data demonstrate the commitment and personal satisfaction found by thoracic residency programs and their faculty in teaching the next generation.

References
DR CALHOON: I have thought about it, and we have discussed it a little bit. We have not teased those out. Similarly, in my own program they are not teased out. It was only until we were putting together the manuscript that I started to think a little more about that. We may go back to the authors, if they will allow me. The administrators and the program coordinators were likely not particularly happy, but very gracious in compiling the data in this survey. It took several hours for people to crunch this and look at it. I would like to go back and make the effort to answer your questions because I do think it is really of benefit. I think that answers your question. Appreciate it.

DR MARK KRASNA (Neptune, NJ): John, that was a really very interesting presentation. Thank you. So one question, if you could drill down a little bit on the cost per resident. Actually your summary estimates close to $30 to $60 billion overall to the whole system. When you get back to the $463,000 per year per resident, roughly, per resident of the institutions that were surveyed, how much money did you receive from the federal government per year?

DR CALHOON: I do not know the answer to that, Mark. It is a good question, and it is a helpful question.

DR KRASNA: I think it might be a source for further negotiation to actually bring forward and show value if we could get that.

DR CALHOON: I think you and Dr Wood have pointed out, we have made a good stab at it, we have got a long way to go to begin to tease this out. Once we start to figure it out, they will change the game, but yes.

DR KRASNA: This year the Medical Group Management Association (MGMA) data were released for the 25th percentile for a new cardiothoracic surgeon, and the salary range is between $350,000 and $380,000. I wonder if you would comment on the value of that MGMA given to a new graduate attending, given that it cost over $463,000 a year to train them. Thank you.

DR CALHOON: I think I would just echo that comment. I do not know that there is further comment.

DR RICHARD SHEMIN (Los Angeles, CA): John, very important study, and a good study that is hard to do. I think you have further documented how underfunded the educational system is to train a cardiothoracic surgeon. I have two questions. One is how much variation in cost there is among different sites? So you have a northeast program like the Massachusetts General Hospital, you have San Antonio program in the southwest, and Stanford, a West Coast program. Is there a lot of regional variation in this cost due to infrastructure and other costs allotted by different hospitals and deans to the finances of the educational system?

DR CALHOON: So it ranged from a little over $300,000 to almost $700,000. One program had the luxury of $100,000-per-year endowment for residents that came back to them as a cost-savings, if you would, a benefit. By training residents they have an endowment that pays for them that took off of that $700,000 and brought it down.

DR SHEMIN: My second comment is somewhat pessimistic. I think there will be future downward pressure on GME by payers who help finance residents such as Medicare. I am concerned the whole system will be underfunded. These data may be helpful in negotiation and making politicians and other stakeholders who support GME aware of the real costs. As committed educators, I think one of the greatest challenges will be to find other sources of funding. As we become increasing constrained by GME funding, perhaps we should also seek reductions in the cost of our residency programs as well as improved efficiency.

DR CALHOON: I think those are good comments. My philosophy has always been that the dean has his hand in my pocket, so I will just try and keep my hand in his.

DR ROBERT HANFLAND (Iowa City, IA): One question I had and then one corollary. The question is: Did any of your respondents say that they had any improved efficiency in the operating room, in being able to run two rooms at once with residents?

DR CALHOON: No, there was no comment. I do not think anybody noted that.

DR HANFLAND: And then the next one, using my phone calculator, if everybody worked their 80-hour work week and followed the rules, I had it down to about $116 an hour. Has there been any thought to comparing that to someone with an equivalent level of education, say, even a lawyer, same number of years postgraduate work, in comparing salaries and like billable rates or anything like that to that number?

DR CALHOON: To my knowledge we have not thought about doing that. It would be an interesting comparison.