Variation in Training for Interventional Pulmonary Procedures Among US Pulmonary/Critical Care Fellowships*  
A Survey of Fellowship Directors  
Nicholas J. Pastis, MD; Paul J. Nietert, PhD; and Gerard A. Silvestri, MD, FCCP;  
for the American College of Chest Physicians Interventional Chest/Diagnostic Procedures Network Steering Committee†  

Study objectives: The American College of Chest Physicians has published guidelines recommending minimum competency requirements for 17 interventional pulmonary procedures. Our aim was to assess what procedures are offered to fellows in US pulmonary/critical care fellowships and to determine whether the recommended competency numbers are being met. 

Methods: Surveys were mailed to 122 pulmonary/critical care fellowship directors in the United States, and fellowship demographics, the types of procedures offered, and the average number of procedures performed were recorded. The presence of a dedicated interventional pulmonologist (IP) was ascertained, and procedural offerings and volume were compared with programs that did not have an IP. 

Results: The response rate of the survey was 77%. There was wide variation in the procedures offered by different programs. The presence of an IP was associated with an increased likelihood of advanced procedural training in brachytherapy (p < 0.05), electrocautery/argon plasma coagulation (p < 0.001), stents (p < 0.001), laser therapy (p < 0.01), rigid bronchoscopy (p < 0.001), and cryotherapy (p < 0.05). For only 3 of the 17 procedures did > 50% of the programs reach the targeted numbers to obtain competency. 

Conclusions: There is a large variation in the spectrum of pulmonary procedures offered to trainees. Programs with a dedicated IP are more likely to offer training in advanced therapeutic procedures. When interventional procedures are offered by fellowships, < 30% of programs meet the competency recommendations. These findings have implications for training, delivery of care, and research. An extra year of fellowship in interventional pulmonology might be desirable if one is to reach the desired competency numbers. An alternative to reaching the recommended numbers for select procedures would be to consider regionalizing care at centers that perform many procedures. Finally, to provide justification for the current competency recommendations, clinical outcomes should be correlated with physicians’ procedural volume, as has been done in other subspecialties.  

Key words: bronchoscopy; fellowship training; interventional procedures; interventional pulmonology 

Abbreviations: ACCP = American College of Chest Physicians; IP = interventional pulmonologist; TBNA = transbronchial needle aspiration 

Over the past 20 years, improvements in technology have led to an explosion in the procedures available for the diagnostic and therapeutic aspects of pulmonary and critical care medicine. While there is tremendous potential to utilize these procedures, it is unclear whether they can be performed outside of specialized centers. The question of what training is presently available to fellows has been incompletely explored, and the implementation of guidelines or credentialing criteria for these procedures has not been consistently applied. Additionally, controversy exists regarding the issue of requiring a minimum number of procedures for the certification of competence. Recognizing that trainees’ manual dexterity and confidence varies, a minimum number of procedures needed to perform a skill or to maintain competence in performing it have not always been required in pulmonary/critical care medicine.1,2 

A large national survey3 of practicing pulmonolo-
gists reinforced the notion that the overall procedural skills of most pulmonologists are inadequate, or at least are not uniform. Only 26% of practicing pulmonologists currently perform all of the procedures that are required for board certification in pulmonary medicine. In 5 of the 13 procedures that were in question, there were ≥20% respondents who stated that they had learned them in practice.3

Other interventional subspecialties in internal medicine have subspecialty boards accredited through the American Board of Internal Medicine that require threshold numbers of supervised procedures to achieve competence. In gastroenterology, there have been two prospective studies5,6 on the number of endoscopic retrograde cholangiopancreatography procedures that are necessary to achieve a specified level of competency. Based on these numbers, a minimum of 200 procedures has been shown to provide the trainee with adequate experience. While interventional fellowships are well-established in cardiology and gastroenterology, there has not been a great push in pulmonology for an additional year of interventional fellowship, and controversy surrounds this topic.

The American College of Chest Physicians (ACCP) has published guidelines7 on interventional procedures with recommendations on the number of procedures to be performed to achieve competence. Experts represented a wide group of physicians within the ACCP, and were composed of pulmonologists, thoracic surgeons, academics, and private practitioners from the United States and abroad, who arrived at a consensus on the recommended competency numbers.7

Within this context, we sought to delineate what interventional training is offered to pulmonary fellows and whether the recommended competency numbers are being met. Once accurate data are collected, recommendations regarding training can be further refined for future pulmonary and critical care fellows.

**Materials and Methods**

A survey was developed by a survey research unit at the Medical University of South Carolina with assistance from the ACCP Interventional Chest/Diagnostic Procedures NetWork Steering Committee. The survey consisted of a list of interventional pulmonary procedures and asked whether each procedure was offered. If offered, the average number of procedures performed was recorded based on averages from either the 2002 or 2003 graduating class. In addition, there were 12 other questions concerning the content of the respondent’s fellowship program (for full survey, see “Appendix 2”). There were three mailings to program directors from 122 accredited pulmonary/critical care fellowship programs in the United States that were listed by the American Medical Association. Surveys were mailed in January, March, and April 2004. If more than one response was received from a program, subsequent surveys from that program were disregarded.

Programs with an interventional pulmonologist (IP) were compared to those without an IP using the χ² test and Fisher exact test, as appropriate. Among programs offering the individual procedures of interest, the χ² test also allowed us to assess whether having an IP was associated with meeting the recommended numbers of procedures for competency. A nonparametric Wilcoxon rank sum test was also used to compare the total number of different types of procedures offered by the various fellowship programs.

**Results**

Surveys were mailed to 122 pulmonary/critical care fellowship programs within the United States. A total of 94 program directors responded (overall response rate, 77%) with 93 answering all questions regarding procedure numbers. Table 1 depicts the procedures offered, the percentage of fellows reaching competence, and the median number of procedures performed, and compares those to the competency numbers recommended by the ACCP. From Table 1, it can be seen that the numbers of procedures to be performed for competency were not met by fellows for the majority of procedures. Only four procedures are offered at >90% of programs, and in only three procedures are the competency numbers achieved >60% of the time. Programs with an IP offered a mean (±SD) of 8.0 ± 2.9 of the procedures listed vs 6.0 ± 2.1 for programs without an IP (p < 0.01 [Wilcoxon rank sum test]).

Program directors were also queried as to the characteristics of their programs and their views on the recommended competency numbers. Of 94 responding program directors, 84 were university hospital-based and 10 were community hospital-based. All fellowships were 3-year programs for accreditation in pulmonary/critical care medicine and had an average of 14 faculty members (range, 6 to 50 faculty members) per program. Forty-nine programs (53%) identified a dedicated IP. There were nine programs (9.5%) in which a single attending pulmonologist supervised >50% of the procedures. In eight of those nine programs (89%), a dedicated IP was identified. When asked whether performing a minimal number of supervised procedures was reasonable to assess competence for privileges, 79 of 92 program directors (85.9%) agreed, while 13 program directors (14.1%) disagreed. There was a relatively equal split between program directors who thought that the minimum requirements recommended by the ACCP were feasible in their institution and those who did not (54.3% vs 45.7%, respectively). Of the 42 program directors who thought that the number
of procedures to be performed for competency were not feasible to attain in their institution, 40 (95.2%) thought that the numbers were too high. Similarly, there was not a strong consensus among program directors when asked whether an extra year of interventional pulmonary training was desirable. Fifty-nine of the program directors (63.4%) either agreed or strongly agreed, 16 (17.2%) were undecided, and 18 (19.4%) either disagreed or strongly disagreed, and this response was no different for programs with and without an IP (p < 0.05).

Figure 1 displays the number of programs offering each procedure and the number of programs achieving the competency numbers for each procedure. Figure 1 also shows the relationship between the presence of an identifiable IP, and both the offering of different procedures and those programs reaching the recommended numbers of procedures to be performed to achieve competency. There was a statistically significant (p < 0.05) association between having an IP on staff, and offering training in electrocautery and argon plasma coagulation, airway stent placement, laser therapy, and rigid bronchoscopy. However, the association between having an IP on staff and reaching the ACCP recommended competency numbers was not statistically significant for any of the other surveyed procedures.

### Discussion

This study has four important findings. First, aside from routine diagnostic procedures such as flexible bronchoscopy, there is a large variation in what is offered to fellows in training. Second, most fellowship programs do not reach the recommended competency numbers recommended by the ACCP Interventional Chest/Diagnostic Procedures NetWork Steering Committee. Third, the presence of an IP is associated with offering more procedures for fellows. Finally, program directors did not agree on the utility of an extra year of training in interventional pulmonology.

The large variation in training may be explained by several factors. In some institutions, physicians in specialties like interventional radiology, thoracic surgery, and otolaryngology perform certain procedures instead of pulmonologists. Some institutions are in close proximity to centers that are known for excellence in certain interventions, so the referrals in that area go to the more renowned centers. Or simply, there may not be enough procedures to go around for trainees to perform.

Surprisingly, procedures such as transbronchial needle aspiration (TBNA), which should be “bread and butter” procedures for pulmonologists, are not performed as often as they could be. Despite having high yield, safety, and cost-effectiveness in tertiary and community-based settings,8–10 TBNA is undertaught and underutilized. A previous survey11 found that most pulmonary/critical care fellows thought they had been adequately trained in flexible bronchoscopy, but only 72.9% had received any instruction in TBNA, and only 27.1% had received any instruction in airway stent placement. The ACCP

<table>
<thead>
<tr>
<th>Procedures</th>
<th>ACCP Recommended Competency No.</th>
<th>Programs Offering Each Procedure, %</th>
<th>Programs Offering the Procedure That Achieve Competency Number, %</th>
<th>Procedures Performed by Fellowships†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible bronchoscopy</td>
<td>100</td>
<td>100</td>
<td>96</td>
<td>150 (80–400)</td>
</tr>
<tr>
<td>TBNA</td>
<td>25</td>
<td>91</td>
<td>65</td>
<td>30 (0–100)</td>
</tr>
<tr>
<td>Tube thoracostomy</td>
<td>10</td>
<td>99</td>
<td>65</td>
<td>12 (0–75)</td>
</tr>
<tr>
<td>Percutaneous pleural biopsy</td>
<td>5</td>
<td>91</td>
<td>65</td>
<td>3.5 (0–25)</td>
</tr>
<tr>
<td>Brachytherapy catheter placement</td>
<td>5</td>
<td>46</td>
<td>51</td>
<td>0 (0–30)</td>
</tr>
<tr>
<td>Electrocautery and/or argon plasma coagulation</td>
<td>15</td>
<td>34</td>
<td>19</td>
<td>0 (0–35)</td>
</tr>
<tr>
<td>Airway stents</td>
<td>20</td>
<td>48</td>
<td>16</td>
<td>0 (0–175)</td>
</tr>
<tr>
<td>Medical thoracoscopy/pleuroscopy</td>
<td>20</td>
<td>12</td>
<td>45</td>
<td>0 (0–20)</td>
</tr>
<tr>
<td>Nd-YAG laser therapy</td>
<td>15</td>
<td>26</td>
<td>33</td>
<td>0 (0–150)</td>
</tr>
<tr>
<td>Rigid bronchoscopy</td>
<td>20</td>
<td>18</td>
<td>41</td>
<td>0 (0–200)</td>
</tr>
<tr>
<td>Autofluorescence bronchoscopy</td>
<td>20</td>
<td>10</td>
<td>22</td>
<td>0 (0–20)</td>
</tr>
<tr>
<td>EBUS</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>0 (0–5)</td>
</tr>
<tr>
<td>Cryotherapy</td>
<td>10</td>
<td>17</td>
<td>19</td>
<td>0 (0–30)</td>
</tr>
<tr>
<td>Photodynamic therapy</td>
<td>10</td>
<td>15</td>
<td>7</td>
<td>0 (0–10)</td>
</tr>
<tr>
<td>TTNA/core</td>
<td>10 aspirates/10 cores</td>
<td>33</td>
<td>9.7</td>
<td>0 (0–50)</td>
</tr>
<tr>
<td>Percutaneous dilational tracheostomy</td>
<td>20</td>
<td>31</td>
<td>28</td>
<td>0 (0–50)</td>
</tr>
<tr>
<td>Transtracheal oxygen therapy</td>
<td>10</td>
<td>24</td>
<td>5</td>
<td>0 (0–10)</td>
</tr>
</tbody>
</table>

*EBUS = endobronchial ultrasound; TTNA = thoracic percutaneous needle aspiration.
†Values given as No. (range).
bronchoscopy survey in 1991 showed that only 11% of pulmonologists who were in practice routinely performed TBNA (≈ 85% of bronchoscopies were associated with cases of lung cancer) and that 49% of pulmonologists rarely performed it (≈ 5% of bronchoscopies were associated with cases of lung cancer). Another survey showed that only a minority of fellows routinely perform TBNA during their training. This study clearly showed that, since the last survey, more programs (91%) are offering training in this procedure and that most programs (69%) are reaching the competency goals set forth in the guidelines.

Since the publication of the ACCP interventional pulmonary procedures guidelines, criticism has been leveled against establishing goals for the numbers of procedures to be performed to achieve competency. The ACCP interventional guidelines were criticized for not surveying program directors, for including “ongoing competency numbers” rather than establishing “initial competencies” alone, and for providing “arbitrary” numbers that could be misinterpreted and misused by credentialing societies. The guidelines were created using evidenced-based techniques in situations in which there was enough evidence and expert opinion when there was not. They were not meant to be rigidly applied but were meant to encourage the performance of an adequate number of procedures to be competent. There is ample evidence in the medical literature that performing medical procedures more often leads to fewer complications. Previous studies have shown that morbidity and mortality are reduced when procedures are performed at centers that achieve the highest volume of those procedures.

The definition of what separates an IP from a pulmonologist remains a gray area, considering that most pulmonary/critical care physicians perform interventions. In cardiology, an interventionalist is clearly defined as one who performs right and left heart catheterizations with angioplasty and stent placement, or one who performs electrophysiologic testing or therapy. Typically, the title of a physician is shown in this survey to correlate with increased training in the key features that are known to define an IP. However, this appears not to be enough as most fellows still fall short of the competency numbers even when there is an IP at their institution. The title of IP is not clearly defined, and it is possible that different institutions have different physicians with the same title and that these physicians may also vary in their involvement with fellows.

Figure 1. Percentages of programs offering various procedures according to the presence of an IP. See Table 1 for expansion of abbreviation not used in text.
who are learning interventional procedures. Some centers allow fellows to perform the procedures under supervision, to be assistants only, or to merely watch. Since the presence of these IPs potentially leads to more training in the key features of interventional pulmonology, perhaps the requirement of certain mandatory skills should be used when developing positions for interventionalists so that they can guarantee opportunities for fellows to perform the key procedures under their supervision.

While more than half of the program directors agreed with the need for an extra year of training in interventional pulmonology, it was not an overwhelming majority. There are significant implications to an extra year of training, such as the need for board/examination credentialing, the addition of more time to a lengthy training program, the dissatisfaction of “noninterventional fellows” who lose procedural opportunities to the “interventional fellow,” and the difficulty in providing training in a new field with a relatively scarce pool of instructors for all of the procedures. How these positions would be funded is another source of angst.

Advantage of an extra year of interventional training is being under the supervision of an expert and meeting his/her approval, which may be the best strategy in lieu of evidence-based competency numbers. The perceptions of trainees and practicing pulmonologists in the past confirm the notion that low numbers of procedures performed in training lead to low levels of performance for these procedures in practice.

In summary, the goal of fellowship training is to ensure that fellows receive the best possible training in both the cognitive disciplines of pathophysiology as well as procedural skills that define our specialty. Clearly, we appear to provide the training for diagnostic bronchoscopy. This study shows improvement in our training in TBNA. However, for interventional procedures, aside from flexible bronchoscopy, the recommended competency numbers are not being met. While the competency numbers in the ACCP guidelines may be too high, it is clear from other studies that mandating that a minimum number of procedures be performed to achieve competency is reasonable, as a higher procedural volume has been shown to lead to less morbidity and mortality. Further, the vast majority of program directors (86%) agree that some minimum number of procedures to be performed to obtain competency should be required. To reach the recommended competency numbers, an extra year of interventional training could be considered. An alternative to reaching the recommended numbers for select procedures would be to consider regionalizing care at centers at which many procedures are performed. Certain centers have already assumed this role, as evidenced by the wide range of average numbers reported in this survey. To provide justification for the current competency recommendations, clinical outcomes should be correlated with physicians' procedural volume. Critics of the ACCP interventional pulmonary guidelines are correct in noting that the guidelines are not completely evidence-based. They represent expert opinion from a broad base of experienced individuals in the field. However, they are a starting point based on the available information from which improved recommendations may be made. This survey provides a framework for understanding the current offerings by pulmonary/critical care fellowship programs for training in different procedures and the volume of such procedures being performed so that clinical outcomes may be measured.

ACKNOWLEDGMENTS: We are indebted to Amy Slav-Livorsi, Senior Project Coordinator, NetWorks, and Tracy Goode, Vice President, NetWorks and Strategic Planning, both of the ACCP, for their work on this project. We are also indebted to the ACCP Interventional Chest/Diagnostic Procedures Network Steering Committee members for their thoughtful review of the survey and the manuscript.

APPENDIX 1: ACCP INTERVENTIONAL CHEST/ DIAGNOSTIC PROCEDURES NETWORK STEERING COMMITTEE

Armin Ernst, MD, FCCP; Neri Cohen, MD, FCCP; Heinrich D. Becker, MD, FCCP; Gordon H. Downie, MD, FCCP; John A. Howington, MD, FCCP; Atul C. Mehta, MBBS, FCCP; Leonard C. Moses, MD, FCCP; W. Roy Smythe, MD, FCCP; Stephen C. Yang, MD, FCCP; and David W. Johnstone, MD, FCCP.
APPENDIX

CONFIDENTIAL PROGRAM DIRECTOR SURVEY

Procedures Offered:
Please indicate whether training for this procedure is offered by your program. If offered, indicate the average number of procedures performed by fellows over the length of their training based on the procedure logs they were required to submit. Use the average number of procedures derived from either the 2002 or 2003 graduated fellow class.

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>RECOMMENDED NUMBER FOR COMPETENCE BASED ON ACCP GUIDELINES</th>
<th>IS PROCEDURE OFFERED?</th>
<th>AVERAGE NUMBER PERFORMED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible Bronchoscopy</td>
<td>100</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Transbronchial Needle Aspiration (TBNA)</td>
<td>25</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Tube Thoracostomy</td>
<td>10</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Percutaneous Pleural Biopsy</td>
<td>5</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Brachytherapy Catheter Placement</td>
<td>5</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Electrocautery and/or Argon Plasma Coagulation</td>
<td>15</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Airway Stents</td>
<td>20</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Medical Thoracostopy/Electrocautery (Nd-YAG)</td>
<td>20</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Rigid Bronchoscopy</td>
<td>20</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Autofluorescence Bronchoscopy</td>
<td>20</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Endobronchial Ultrasound (EBUS)</td>
<td>50</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Cryotherapy</td>
<td>10</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Photodynamic Therapy</td>
<td>10</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Thoracic Percutaneous Needle Aspiration/Core (TTNA)</td>
<td>10 aspirates 10 core biopsies</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Percutaneous Dilatational Tracheostomy</td>
<td>20</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Transtracheal Oxygen Therapy</td>
<td>10</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
CONFIDENTIAL PROGRAM DIRECTOR SURVEY

Program Demographics:
Please fill in the blank lines or check the box regarding the demographics of your fellowship program.

1. Name of your institution/city/state:

________________________________________

2. Average number of trainees per year: ________

3. Which best describes your fellowship type?
   a. Community hospital ☐
   b. University hospital ☐
   c. Three year accredited Pulmonary/Critical Care ☐
   d. Two year accredited Pulmonary only ☐

4. Number of attending physicians on faculty with direct fellow contact: ________

5. Do you have an identifiable interventional pulmonologist? ☐ Yes ☐ No

6. Does a single attending pulmonologist supervise > 50% of the procedures? ☐
   Yes ☐ No

7. Are interventional procedures performed in a dedicated bronchoscopy unit? ☐
   Yes ☐ No

8. To assess competency for privileges is it reasonable to require performance of a minimal number of supervised procedures for certification? ☐ Yes ☐ No
   If no, why not?

9. Do you believe that an extra year of interventional pulmonary training is desirable for competency in some or most of the procedures listed above?
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

10. The ACCP interventional pulmonary guidelines contain specific recommendations on numbers of procedures to assess competence. Do you feel that these minimal requirements are feasible in your institution for the procedures you offer?
    ☐ Yes ☐ No
    If not, are the requirements ☐ too high in number or ☐ too low in number?

11. Open comments (optional):
REFERENCES
1 Haponik E, Shure D. Underutilization of transbronchial needle aspiration: experiences of current pulmonary fellows. Chest 1997; 112:251–253
2 Evaluation of trainees in pulmonary disease. Portland, OR: American Board of Internal Medicine, 1989
4 Feller-Kopman D. Is a dedicated 12-month training program required in interventional pulmonology? J Bronchol 2004; 11:63