CHEST Topics in Practice Management

Understanding the Economic Impact of Introducing a New Procedure

Calculating Downstream Revenue of Endobronchial Ultrasound With Transbronchial Needle Aspiration as a Model

Nicholas J. Pastis, MD, FCCP; Suzanne Simkovich, MPAcc; and Gerard A. Silvestri, MD, FCCP

Over the last decade, endobronchial ultrasound (EBUS) evolved into a validated and powerful diagnostic tool. Although it is integral to medical care in some health-care systems, others struggle to justify its purchase based on diminishing reimbursement. In analyzing its value to a health-care system, looking at procedural reimbursement alone will grossly underestimate its economic impact. Downstream revenue has been defined by administrators as revenue captured after patients use one hospital service and then use others. By analyzing consecutive EBUS cases and taking downstream revenue into account, $2.4 million in collections was attributed to 97 patients who were newly referred for this procedure. ***CHEST 2012; 141(2):506–512***

Abbreviations: EBUS = endobronchial ultrasound; EBUS-TBNA = endobronchial ultrasound with transbronchial needle aspiration; EP = established patient; EUS = endoscopic ultrasound; MUSC = Medical University of South Carolina; NP = new patient; NPBI = new patient, brief interaction; NPCC = new patient, continued care; TBNA = transbronchial needle aspiration

Despite the value of procedural technology to hospital systems, the days of carte blanche spending of hospital funds on new equipment have ended. Financial reimbursements for procedures have fallen, and before hospital administrators will relinquish funds, a business plan must justify new investments with projected financial benefit to the institution.

Endobronchial ultrasound with transbronchial needle aspiration (EBUS-TBNA) was recently introduced into medical practice. Studies have validated its use to help physicians diagnose and stage lung cancer and lymphoma, diagnose sarcoidosis, and sample lymph nodes that were previously inaccessible to traditional transbronchial needle aspiration (TBNA).[1-8] A recent randomized controlled trial showed that staging non-small cell lung cancer by combining EBUS-TBNA with endoscopic ultrasound (EUS) resulted in a higher sensitivity for mediastinal lymph node metastasis and fewer unnecessary thoracotomies when compared with surgical staging alone.[9]

For editorial comment see page 288

Prior to January 2008, the facility-based reimbursement for an EBUS-TBNA bronchoscopy was $1,985, making the purchase of this technology attractive to hospitals. However, the extra facility-based reimbursement set by the Centers for Medicare and Medicaid Services was eliminated when the final code for this technology was established. The 2010 Medicare hospital outpatient payment for an EBUS-TBNA bronchoscopy is the same as a bronchoscopy with

Manuscript received January 31, 2011; revision accepted June 17, 2011.
Affiliations: From the Division of Pulmonary and Critical Care, Medical University of South Carolina, Charleston, SC.
Funding/Support: This study was supported by an unrestricted grant from Olympus, Inc.
Correspondence to: Gerard A. Silvestri, MD, FCCP, Medical University of South Carolina, 96 Jonathan Lucas St, MSC 630, Charleston, SC 29425-6300; e-mail: silvestri@musc.edu

DOI: 10.1378/chest.11-0254

traditional TBNA ($723).[10,11] Faced with the decision to purchase EBUS-TBNA equipment without this extra payment, hospitals have become reluctant to spend between $90,000 and $130,000 to acquire it. However, a basic capital budgeting analysis based strictly on return from the procedure itself may be overly simplistic and not account for other benefits to the hospital system such as the additional testing, consultations, new referrals into the system, and other procedures related to the initial referral for EBUS-TBNA.[12]

We undertook this study to evaluate the global economic impact of introducing an EBUS-TBNA service to a medical center. We hoped to develop methodology that could be used to evaluate the introduction of other procedures into pulmonary practice.

Materials and Methods

Three hundred and sixty-seven EBUS-TBNA procedures were performed at the Medical University of South Carolina (MUSC) during 2008 and 2009, of which 200 consecutive EBUS-TBNA cases were reviewed for this study. A start date of June 30, 2008, was chosen at random. The study was approved by the Institutional Review Board at the MUSC.

Additional devices were required for these procedures to be used in conjunction with preexisting standard bronchoscopic video monitors. All EBUS-TBNA procedures were performed with a BF-UC160F-OL8 bronchoscope, NA-201SX-4022 single-use aspiration needles, and an EU-C60 ultrasound processor (Olympus America). All physician faculty members at MUSC are members of our physician practice plan and are either salaried employees or have a base salary with built-in clinical productivity incentives.

A medical records review was performed, and patients were categorized as either established patients (EPs) or new patients (NPs) to the health-care system within 30 days of the EBUS-TBNA. The NPs were referred by physicians not affiliated with MUSC. The NPs were subdivided into those who had a brief interaction of less than six visits and no hospitalizations (NPBIs) and those who remained in the system for continued care (NPCCs) (Fig 1). Revenue was divided based on EPs and NPs to clarify how many patients entered the system because of EBUS-TBNA. We concentrated this evaluation on the NPs so that the economic benefit analysis would be conservative. If EPs were included, it could be argued that the additional financial impact from the procedure in this subset would have occurred anyway. Another reason to subdivide NPs was to further differentiate revenue based on referrals for patients who returned to their health-care system of origin (NPBIs) and those who stayed for continued care (NPCCs) and were thus responsible for the greatest downstream revenue.

Once each patient's category was determined, the chart was abstracted. Patient demographics, distance from our institution, and diagnosis (cancer vs other) were recorded (Table 1). Medical records were reviewed to identify and abstract the services used by each patient that were directly related to EBUS-TBNA. Variables collected for revenue analysis included the number of radiologic studies, consults to other specialties (eg, thoracic surgery, medical oncology, etc), pathology consults, hospitalizations, procedures, and treatments related to the diagnosis made using EBUS-TBNA. Data from chart abstraction were collected in the REDCap[13] database system. The pathway for clinical workup of EBUS-TBNA patients in this study is shown in Figure 2.

For NPs, collections (not charges) were obtained from both professional and technical billing. Collections were calculated from 30 days prior to 180 days after the procedure. The 30 days prior to the procedure were included because part of the initial NP consultation for EBUS-TBNA could include ordering additional studies, such as CT scans, PET scans, or pulmonary function tests. Other diagnostic tools used at MUSC to diagnose lung cancer (eg, CT scan-guided biopsy, other bronchoscopies including navigational procedures, and EUS fine-needle aspiration) were included. To avoid counting collections unrelated to the initial EBUS-TBNA, 180 days after the EBUS-TBNA procedure was felt to be a conservative time period to allow for the measurement of downstream revenue from the procedure, though clearly patients with a cancer diagnosis could produce considerable downstream revenue past 180 days. Professional collections were recorded according to departments within the hospital system, and technical collections were recorded according to the diagnosis-related group (DRG) charge. Our institution's payer mix is shown in Figure 3. Both professional and technical fee collections were included for all services lines that were part of the revenue analysis.

Since EPs are expected to continue care at our institution, only the downstream services directly related to the EBUS-TBNA were recorded. Collections were not determined for these patients. Services were considered directly related to EBUS-TBNA when a diagnosis was made using EBUS-TBNA that led to further diagnostic workup or treatment within the system. These services were counted for a 180-day period following the EBUS-TBNA. The majority of the EBUS-TBNA procedures are outpatient procedures, so these situations were rare, but when patients who were hospitalized underwent EBUS-TBNA, they were considered EPs even when they had no prior encounters with the system. These hospitalizations were not included in the count of the number of hospitalizations since the reason for hospitalization was not directly associated with the EBUS-TBNA. The EBUS-TBNA and services related to the procedure (eg, consults, radiographic imaging) were counted in the encounters with the hospital system.

Patients who were hospitalized and underwent EBUS-TBNA were considered EPs even when they had no prior encounters with the system. These hospitalizations were not included in the count of the number of hospitalizations since the hospitalization was not directly associated with endobronchial ultrasound (EBUS). EBUS and services related to the procedure (eg, consults, radiographic imaging) were counted in the encounters with the hospital system.

Results

Of the 200 patients who underwent EBUS-TBNA in this analysis, 97 were EPs and 103 were NPs. A significant proportion of the EPs lived close to the facility (42% were from ≤ 20 miles away) when compared with the NPs. Among the103 NPs to the system, 35% traveled > 20 miles and < 150 miles and 50% traveled ≥ 150 miles to obtain an EBUS-TBNA procedure. Our typical catchment area is a three-county region measuring 90 miles and supplying health care to a population of about 500,000.

Lung cancer was present in 49% of all patients, and metastatic cancer from another primary site was found in 7% (Table 1). The NPCC group had the

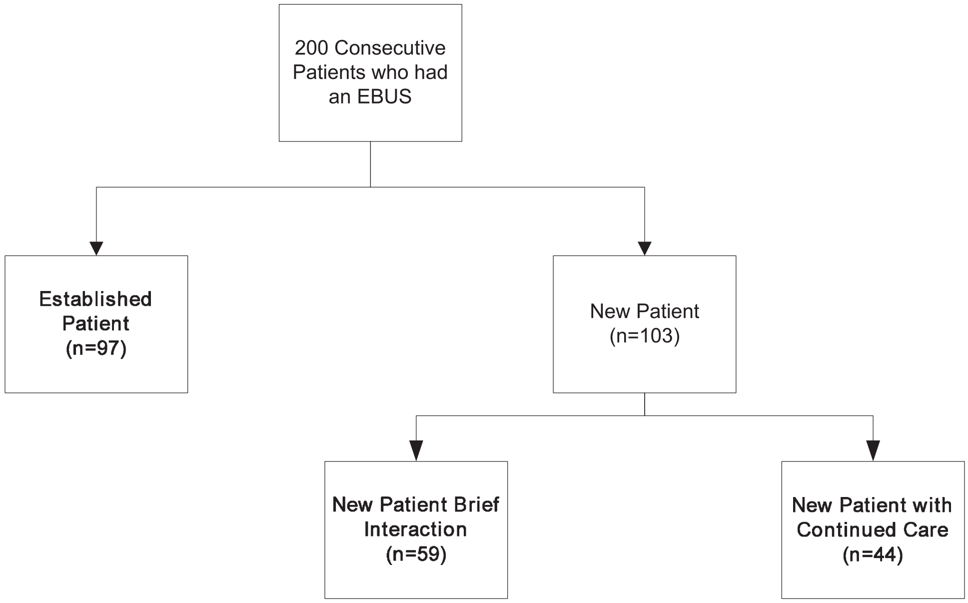

FIGURE 1. Patient categories based on type of interaction with the health-care system. EBUS = endobronchial ultrasound.

greatest percentage of cancer diagnoses (75% diagnosed with lung or metastatic cancer) by EBUS-TBNA.

The diagnostic and therapeutic encounters with the hospital system as a result of the EBUS-TBNA referrals are listed in Table 2 for the NPs and EPs. Additionally, in the 30 days prior to EBUS-TBNA, the NPs underwent 30 radiologic studies, 94 consults, and 28 procedures that were done as part of the EBUS-TBNA referral.

While the EPs accounted for the majority of the encounters following EBUS-TBNA, the NPs who continued care at the institution (NPCCs) had a very similar number of encounters following the EBUS-TBNA procedure (Table 2). Both groups underwent identical numbers of chemotherapy treatments and almost identical numbers of consults and hospitalizations.

The payer mix at this institution was composed primarily of Medicare, Medicaid, and indigent care. Private insurance only made up 31% of the payer mix (Fig 3). The collections received by the hospital that were attributable to NPs who underwent EBUS-TBNA were $2.4 million. Of this, $1.97 million was generated from technical fees and $440,000 from professional fees. Therefore, the downstream collections from technical fees per EBUS-TBNA were $19,174. The rate of collections was approximately 25% of billed charges, which corresponds with the known collection rates in our hospital system.

Table 1—*Demographics*

Patient Characteristics	EPs	NPBIs	NPCCs
No. of participants	97	59	44
Average age, y	59	59	61
Sex	Female, 47 (48)	Female, 29 (49)	Female, 18 (41)
	Male, 50 (52)	Male, 30 (51)	Male, 26 (59)
Race	Black, 34 (35)	Black, 10 (17)	Black, 12 (27)
	White, 62 (64)	White, 49 (83)	White, 31 (70)
	Hispanic, 1 (1)		Asian, 1 (2)
Travel distance	≤ 20 miles, 41 (42)	≤ 20 miles, 5 (8)	≤ 20 miles, 11 (25)
	21-149 miles, 38 (39)	21-149 miles, 18 (31)	21-149 miles, 18 (41)
	≥ 150 miles, 18 (19)	≥ 150 miles, 36 (61)	≥ 150 miles, 15 (34)
Primary diagnosis	Lung cancer 43 (44)	Lung cancer, 27 (46)	Lung cancer, 28 (64)
	Metastatic cancer 7 (7)	Metastatic cancer, 2 (3)	Metastatic cancer, 5 (11)
	Granulomatous disease (including sarcoidosis), 38 (39)	Granulomatous disease, (including sarcoidosis), 26 (44)	Granulomatous disease (including sarcoidosis), 7 (16)
	Other, 9 (9)	Other, 4 (7)	Other, 4 (9)

Data shown as No. (%) unless otherwise indicated. EP = established patient; NPBI = new patient, brief interaction; NPCC = new patient, continued care.

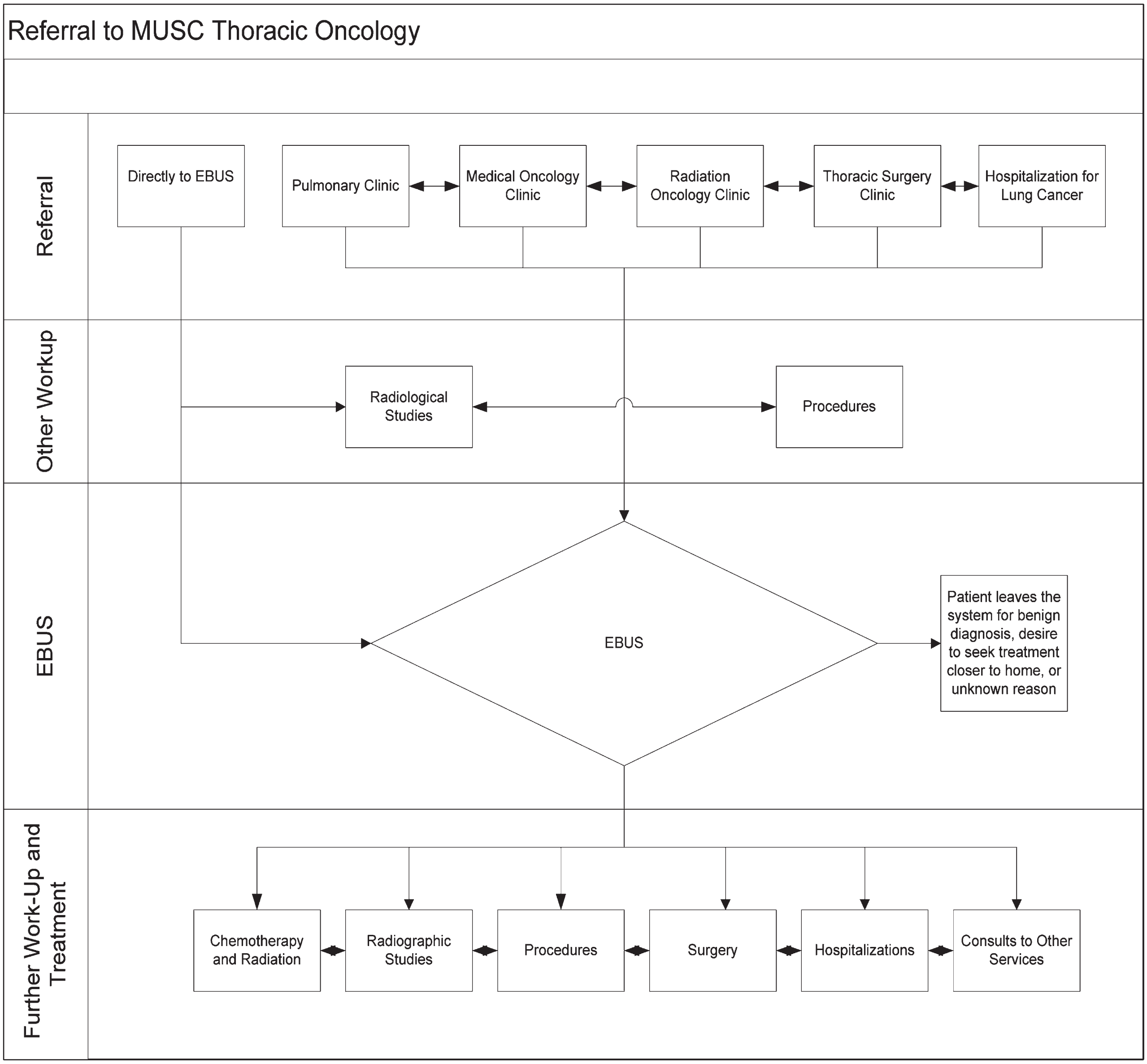

Figure 2. Patient flow relative to EBUS with transbronchial needle aspiration (EBUS-TBNA). MUSC = Medical University of South Carolina. See Figure 1 legend for expansion of other abbreviation.

Discussion

This study has several important findings: First, over a 13-month time frame, 97 NPs generated \$2.4 million in collections. Were we to estimate the collections generated by the procedure alone, it would be \$70,131 (97 patients times a \$723 Medicare national average hospital outpatient payment for Current Procedural Terminology code 31629).[10] This is a conservative estimate that only includes this payment and not any ancillary charges, such as anesthesia, which were not used for any of these procedures. Second, when the NPs were referred and remained in the system, their use of hospital services was similar to that of the EPs. Third, patients traveled from outlying areas served by other hospital systems to obtain this procedure and further services such as radiologic studies, chemotherapy, radiation therapy, or surgery.

Previous literature on EBUS-TBNA focused on savings incurred to patients and health-care systems for having the procedure available.[3,14] Cost analyses of EBUS-TBNA have demonstrated a savings by reducing the number of mediastinoscopies[3,14] and PET scans.[14] This benefit carries more weight in countries with universal government-supported care. In the US health-care system, the financial bottom line remains a critical issue to hospital systems, so relying on cost savings as a selling point to hospitals in the United States may not work. To the authors'

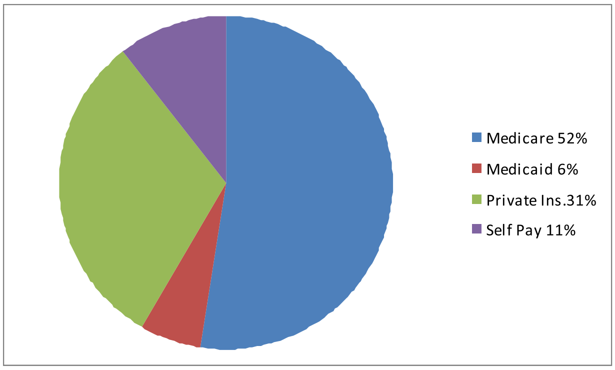

FIGURE 3. Payer mix for 103 new patients referred for EBUS-TBNA ("Self Pay" includes indigent care). See Figure 2 legend for expansion of abbreviation.

knowledge, this is the first study to examine the downstream financial benefit of EBUS-TBNA to a hospital system. A similar technology, EUS, has been shown to generate downstream procedures and professional charges that attenuate the lower reimbursement for a half day of EUS compared with a half day of colonoscopy.[15] It should be noted that unlike EBUS-TBNA, which lost an additional technical fee relative to traditional bronchoscopy with TBNA, EUS still commands an additional technical fee reimbursement.

On the surface, a capital investment of $90,000 to $130,000 plus ongoing maintenance costs of as much as $100 per procedure[16] seem particularly high, especially if the calculation is made using only the reimbursement for that procedure when making decisions about capital investment. By calculating downstream revenue to a health-care system, we were able to demonstrate that for a capital investment of approximately $100,000, the health-care system could generate $2.4 million in collections after 13 months of having an EBUS-TBNA service (based on revenue generated from all 97 NPs, each followed for 7 months). This calculation was based on the purchase of only 1 EBUS bronchoscope and allowed for periods when the bronchoscope was damaged and procedures had to be postponed (typically < 1 week turnaround for repairs). A different way to calculate this would be based on collections per patient ($2.4 million per 97 patients). Both are conservative estimates but further validate the point that investing in this technology was worth the cost. These calculations are based on the payer mix from a state-supported academic medical center that likely has a lower percentage of private insurance coverage compared with private health-care institutions. In an employment arrangement like this one, where physicians are fully employed by a hospital system, there is more likely to be a collaborative atmosphere among employed physicians and the hospital financial department. In a private hospital system, where physician employment is separate from the hospital system, there may be more barriers to obtaining financial information to make estimates of profit from a new procedure. Relatively speaking, the financial benefit to pulmonologists is modest. The technical fee is the same as that for a traditional blind TBNA, and the professional fee is only slightly more. These reimbursement rates are low relative to the procedural time, especially for complete mediastinal staging procedures. This represents time away from potentially higher paying endeavors by the pulmonologist, such as critical care time, outpatient collections, or polysomnography interpretation. In striking comparison, the financial gain to other services such as medical oncology, radiology, and radiation oncology from an EBUS-TBNA program is large. To reimburse physicians performing EBUS-TBNA in a more equitable way, a future direction may entail revenue sharing, where physicians receive compensation in whole or in part based on the economic benefit of their services (eg, cancer care) to the hospital. Alternatively, local centers of excellence in EBUS-TBNA may develop that maintain the necessary procedural volume to justify purchase of the necessary equipment and avoid duplication of expenses by smaller hospitals.

Having an EBUS-TBNA program led to the referral of NPs to our health-care system (52% of EBUS-TBNA referrals), of which a significant proportion (43%) stayed in our system. We found that providing an EBUS-TBNA service captured patients statewide and from neighboring states, thus expanding the catchment area of the hospital system. As evidenced by advertisement campaigns, health-care systems are interested in the potential of new technology, particularly minimally invasive techniques, to attract patients who otherwise would have been treated by other systems. The NPs who stayed for care in our system (NPCCs) used hospital resources like the EPs did. This key finding supports a very broad financial benefit of EBUS-TBNA to a hospital system:

Table 2—*No. of Encounters with the Health-care System After EBUS-TBNA*

Encounters	NPBIs	NPCCs	EPs
Radiologic studies	22	275	305
Consults (includes initial consult for EBUS-TBNA)	88	459	470
Hospitalizations	0	33	31
Procedures (surgery, interventional radiology, and other endoscopy)	14	44	61
Radiation therapy	0	240	310
Chemotherapy	0	88	88

EBUS-TBNA = endobronchial ultrasound with transbronchial needle aspiration. See Table 1 legend for expansion of other abbreviations.

Patients, even from a significant distance, can continue their medical care in the institution where the EBUS-TBNA is performed.

Subtle benefits may also be realized by expanding the referral pattern of a hospital. Satisfaction with the services that were downstream from the initial EBUS-TBNA is a likely source of positive advertisement and future referrals. Of patients undergoing EBUS-TBNA, cancer was the most common diagnosis, accounting for nearly half of the patients undergoing this procedure. To the extent that some hospitals market comprehensive cancer care, the high proportion of patients who undergo EBUS-TBNA for cancer would be attractive to hospital administrators. Routine use of EBUS-TBNA may also help galvanize together a multidisciplinary oncologic approach including pulmonologists, radiologists, medical oncologists, radiation oncologists, and thoracic surgeons. Having multidisciplinary cancer clinics has been shown to increase patient satisfaction,[17] and it may have led to the continuity of care between the NPCC group and the hospital system that was seen in this study. A potential strategy to gain funding from hospital administrators may be to partner with other specialties that treat patients with cancer and that would stand to benefit from the introduction of EBUS-TBNA.

Weaknesses of this study include its retrospective method: the fact that it was performed at a tertiary care center with pulmonologists trained in EBUS-TBNA and with a large multidisciplinary thoracic oncology program with high volumes. This may make it less reproducible in the community hospital setting. In addition, it could be argued that some NPs who were referred for EBUS-TBNA could have been referred anyway by virtue of our institution being a tertiary referral center with extended resources. This referral center is the only comprehensive university medical center in the state and is a National Cancer Center-designated center, so many services or clinical trials are not available elsewhere in the state. The institution enjoys opportunities to retain patients even after procedures such as EBUS-TBNA are performed. In our case, retention of patients was not typically a point of contention to referring physicians when thoracic oncology services were unique to this institution relative to our surrounding region. This may not be the case at other institutions that are far less likely to retain NPs referred for EBUS-TBNA due to the presence of comprehensive medical centers in the close vicinity.

When introducing EBUS-TBNA, loss of revenue from existing procedures was excluded from our calculation. Hospital systems could argue that revenue was lost from procedures such as mediastinoscopy, which has greater financial reimbursement than EBUS-TBNA. Although this procedure carries a higher risk, it remains an acceptable alternative, and there may be important economic incentives to physicians and hospital systems performing it.

The strengths of the study included the use of conservative economic estimates to avoid bias. While we tracked the services used by EPs related to EBUS-TBNA, we purposely did not include their downstream collections in our revenue analysis. By excluding this downstream revenue, we underestimated the overall revenue because some of the profits (eg, radiologic, pathologic, consultations) can be cost accounted to the procedure. NPs were divided into NPBIs and NPCCs to demonstrate the proportion of patients who remained in the system after EBUS-TBNA. In addition, collections rather than charges were used, which provided a more conservative estimate of revenue, especially considering the payer mix at a state-supported institution.

How should physicians proceed when considering introducing new technology? First, perform a needs assessment. Second, perform an environmental scan of resources such as the availability of space and ancillary support. Third, the physician must address issues such as the need and availability of training and the effect of local competition on estimates of procedural volume. One must realize that a gain in referrals from one sector of the referral base could lead to a loss in referrals from another if it is perceived that new technology threatens existing approaches used by other physicians. Physicians must assess their own

Table 3—*Requisite Assessment Prior to Initiating a New Procedural Technology*[a]

Assessment Points
Is there a need for the procedure?
Do you have the referral base?
Consider whether the procedure is available locally or regionally.
Perform an environmental scan.
Include an evaluation of finances, space, personnel, and support services (eg, cytology, radiology, etc).
What is the effect of local competition on estimates of procedural volume?
What, if any, are the training requirements?
Do you have time to commit to the procedure (physician training, endoscopy personnel training, and physician time away from routine practice)?
Engage the hospital administration and important stakeholders early in the assessment to use their resources and advice.

[a]Hospital systems possess resources to help answer these questions.

time demands, skills, and training. In order to capitalize on a hospital system's resources to acquire data on local health-care needs, the hospital administration should be involved early. Hospital administrators provide a specific and important set of skills (eg, financial analysis, hospital budgeting processes, development of business pro forma, identification of barriers, etc) that can improve a physician's chance of success. Presenting your plan to those making purchasing decisions is best done in tandem with the physician extolling the clinical need and the administrator supporting the financial viability of the technology. Identify stakeholders who stand to gain and those who stand to lose from the introduction of the new technology (eg, cancer center director, division chief, members of the thoracic oncology working group). Engage these individuals early in the process to use their resources and advice (Table 3).

To summarize, while this calculation of downstream revenue may not be reproducible in all medical centers, there is value in applying it to health-care systems contemplating the purchase of EBUS-TBNA. Modest reimbursement for valuable diagnostic tools should not dissuade hospitals from purchasing when downstream revenue has been shown to justify the capital investment. The presence of new and effective technology drew patients to our hospital system from outside the typical referral base, many of whom stayed in the system and generated downstream revenue similar to that of EPs. We propose that there are also intangible benefits such as marketing for the institution and capturing patients into the system who would otherwise have been treated elsewhere.

Acknowledgments

Financial/nonfinancial disclosures: The authors have reported to *CHEST* the following conflicts of interest: Dr Pastis has received a consulting fee from Olympus, Inc for preparing and delivering an educational webinar to the Olympus EBUS sales force. Dr Silvestri has received grant funding from Olympus, Inc for this study and other research projects. Ms Simkovich has reported that no potential conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.
Role of sponsors: The sponsor had no role in the design of the study, the collection and analysis of the data, or in the preparation of the manuscript.

References

1. Garwood S, Judson MA, Silvestri G, Hoda R, Fraig M, Doelken P. Endobronchial ultrasound for the diagnosis of pulmonary sarcoidosis. *Chest*. 2007;132(4):1298-1304.
2. Gomez M, Silvestri GA. Endobronchial ultrasound for the diagnosis and staging of lung cancer. *Proc Am Thorac Soc*. 2009;6(2):180-186.
3. Vincent BD, El-Bayoumi E, Hoffman B, et al. Real-time endobronchial ultrasound-guided transbronchial lymph node aspiration. *Ann Thorac Surg*. 2008;85(1):224-230.
4. Silvestri GA. The mounting evidence for endobronchial ultrasound. *Chest*. 2009;136(2):327-328.
5. Herth FJ, Eberhardt R, Krasnik M, Ernst A. Endobronchial ultrasound-guided transbronchial needle aspiration of lymph nodes in the radiologically and positron emission tomography-normal mediastinum in patients with lung cancer. *Chest*. 2008;133(4):887-891.
6. Herth FJ, Krasnik M, Vilmann P. EBUS-TBNA for the diagnosis and staging of lung cancer. *Endoscopy*. 2006;38(suppl 1): S101-S105.
7. Herth FJ, Eberhardt R. Actual role of endobronchial ultrasound (EBUS). *Eur Radiol*. 2007;17(7):1806-1812.
8. Herth FJ, Ernst A, Eberhardt R, Vilmann P, Dienemann H, Krasnik M. Endobronchial ultrasound-guided transbronchial needle aspiration of lymph nodes in the radiologically normal mediastinum. *Eur Respir J*. 2006;28(5):910-914.
9. Annema JT, van Meerbeeck JP, Rintoul RC, et al. Mediastinoscopy vs endosonography for mediastinal nodal staging of lung cancer: A randomized trial. *JAMA*. 2010;304(20): 2245-2252.
10. Centers for Medicare and Medicaid Services. Federal Register Part III. Centers for Medicare and Medicaid Services Web site. http://www.cms.hhs.gov/quarterlyproviderupdates/downloads/cms1392fc.pdf. 2007. Accessed November 24, 2010.
11. Centers for Medicare and Medicaid Services. Medicare program: changes to the hospital outpatient prospective payment system and cy 2010 payment rates; changes to the ambulatory surgical center payment system and cy 2010 payment rates; corrections; final rule, notice, and proposed rule. 42 CFR §410, 416, and 419. 2010; 336.
12. Fahey P, Cruz-Huffmaster D, Blincoe T, Welter C, Welker MJ. Analysis of downstream revenue to an academic medical center from a primary care network. *Acad Med*. 2006;81(8): 702-707.
13. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381.
14. Callister ME, Gill A, Allott W, Plant PK. Endobronchial ultrasound guided transbronchial needle aspiration of mediastinal lymph nodes for lung cancer staging: A projected cost analysis. *Thorax*. 2008;63(4):384.
15. Atkinson M, Schmulewitz N. Downstream hospital charges generated from endoscopic ultrasound procedures are greater than those from colonoscopies. *Clin Gastroenterol Hepatol*. 2009;7(8):862-867.
16. Hergott CA, MacEachern P, Stather DR, et al. Repair costs for endobronchial ultrasound bronchoscopies. *J Bronchol Intervent Pulmonol*. 2010;17:223-227.
17. Gabel M, Hilton NE, Nathanson SD. Multidisciplinary breast cancer clinics. Do they work? *Cancer*. 1997;79(12): 2380-2384.