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The Choosing Wisely Top Five List in Adult Pulmonary Medicine

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The American Board of Internal Medicine Foundation's Choosing Wisely campaign aims to curb health-care costs and improve patient care by soliciting lists from medical societies of the top five tests or treatments in their specialty that are used too frequently and inappropriately. The American Thoracic Society (ATS) and American College of Chest Physicians created a joint task force, which produced a top five list for adult pulmonary medicine. Our top five recommendations, which were approved by the executive committees of the ATS and American College of Chest Physicians and published by Choosing Wisely in October 2013, are as follows: (1) Do not perform CT scan surveillance for evaluation of indeterminate pulmonary nodules at more frequent intervals or for a longer period of time than recommended by established guidelines; (2) do not routinely offer pharmacologic treatment with advanced vasoactive agents approved only for the management of pulmonary arterial hypertension to patients with pulmonary hypertension resulting from left heart disease or hypoxemic lung diseases (groups II or III pulmonary hypertension); (3) for patients recently discharged on supplemental home oxygen following hospitalization for an acute illness, do not renew the prescription without assessing the patient for ongoing hypoxemia; (4) do not perform chest CT angiography to evaluate for possible pulmonary embolism in patients with a low clinical probability and negative results of a highly sensitive D-dimer assay; (5) do not perform CT scan screening for lung cancer among patients at low risk for lung cancer. We hope pulmonologists will use these recommendations to stimulate frank discussions with patients about when these tests and treatments are indicated—and when they are not.

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Abbreviations: ATS = American Thoracic Society; NLST = National Lung Screening Trial; PE = pulmonary embolism

The United States spends more per capita on health care than any other developed nation.[1] Although spending more money yields health benefits in some contexts, the United States has crossed onto the "flat of the curve," in which spending more does not improve health.[2] Research on geographic variations in health-care spending has shown that spending more money, doing more testing, and providing more expensive treatments does not consistently yield better outcomes.[3] In fact, in many cases, overtesting and overtreatment can cause harm, as patients are exposed to radiation from extraneous imaging, physical complications from invasive procedures that are not clearly indicated, and adverse effects from unwarranted medications.[4]

Physicians have professional obligations to both their individual patients and to society.[5] As such, it is incumbent upon physicians to help rein in the use of tests and treatments that offer little benefit, may cause harm, and add considerable expense. The question is, where to begin? It can be difficult for busy clinicians to stay up-to-date on the latest evidence on the benefits and harms of all tests and treatments in their field, and

very few clinicians are fully cognizant of the costs associated with the care they provide.[6,7] For these reasons, in 2010, Howard Brody,[8] MD, PhD, challenged medical societies to compile evidence-based lists of the top five tests or treatments in their specialty that are commonly used at great expense, but that provide little benefit.

The American Board of Internal Medicine Foundation (ABIM) took the next step to make Dr Brody's vision a reality, initiating the Choosing Wisely campaign.[9] Choosing Wisely strives "to reduce overuse of tests and procedures and support physician efforts to help patients make smart and effective choices."[10] To date, >50 societies have partnered with Choosing Wisely to create top five lists. The American College of Chest Physicians and American Thoracic Society (ATS) joined forces to produce the top five list for adult pulmonary medicine.

Materials and Methods

To promote consistency with other Choosing Wisely lists, the ATS and American College of Chest Physicians agreed prospectively that this document would not be developed in accordance with the methodologic standards of the Institute of Medicine, ATS, or American College of Chest Physicians for clinical practice guidelines, but would reflect a consensus from a joint ATS/American College of Chest Physicians task force.

In September 2012, the leaderships of the ATS and American College of Chest Physicians each nominated up to five members to join the task force. The final task force included eight pulmonologists (this statement's authors). Task force members were selected to provide expertise in a broad range of areas within adult pulmonary medicine and included representatives from geographically diverse areas with experience in university hospitals, Veterans Health Administration medical centers, community-based integrated health-care systems, private practice, specialty services benefits management, and health-care administration.

During an initial meeting, we established the goals and ground rules guiding our task force. We agreed upon the following criteria for assessing potential items for inclusion in the top five list: (1) strength of evidence (how sure are we that our suggestion is correct?); (2) prevalence (how commonly do we think this issue arises?); (3) aggregate cost (how large are the anticipated cost savings if this suggestion is adhered to?); (4) relevance (to what extent is this a "core" or "unique" part of our profession, as opposed to an ancillary activity or part of good practice more generally?); (5) innovation (how much does this suggestion "move the needle" rather than recapitulate known best practices?).

Task force members then submitted suggested items to the task force lead (R. S. W.). Members derived items from multiple sources, including the literature, review of existing Choosing Wisely top five lists, feedback from community pulmonologists, and personal experience. The task force lead collated items, removed duplicates, and circulated the initial list of 30 unique items to the task force.

During the next meeting, we discussed each of these 30 items, debated the impact of each based on the five assessment criteria, and reached consensus on 10 items to explore in greater depth (Table 1). Working together with the task force lead, each task force member refined the wording of one to two items and an accompanying paragraph explaining the rationale for its inclusion. In doing so, the member synthesized the published literature relevant to the recommendation(s) and consulted with one to two content experts external to the task force (see the Acknowledgments section) to ensure the recommendation's appropriateness. Task force members then returned their refined item(s) to the task force lead with a list of supporting references. The lead compiled and distributed the list of 10 items and accompanying materials to the entire task force.

At our next meeting, we carefully reviewed all 10 proposed items. For each item, the designated member presented information relevant to the five assessment criteria, while others raised questions to clarify the intent, supporting evidence, impact, or relevance of the recommendation. After all views were heard, members independently rated each item on its overall impact as well as on each criterion. We agreed that the overall rating need not be an average of the criteria ratings, thereby enabling members to weigh certain criteria more heavily.

Task force members submitted their scores to the lead, who averaged members' scores and ranked the items based on their mean overall score. The five items with the best overall scores were retained in a "penultimate" list. The task force jointly edited the five recommendations and accompanying paragraphs to ensure clarity prior to submitting the list to the ATS and American College of Chest Physicians executive committees.

The executive committees sought feedback from additional content experts, discussed the items internally, and provided written comments on each item to the task force. The task force incorporated these suggestions; when nuances were disputed, we held discussions with the societies' leaderships to resolve disagreements, resulting in mutually agreeable wording changes.

The final list was then submitted to both societies' executive committees. Both the ATS and American College of Chest Physicians elected to endorse the final top five list. The joint ATS/American College of Chest Physicians top five list in adult pulmonary medicine was released by the Choosing Wisely campaign in October 2013.[10]

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Table 1—*Ten Proposed Items Explored in Further Detail, Including In-depth Literature Review and Feedback From External Content Experts*

Proposed Items
1. Do not perform chest CT (CT angiography) to evaluate for possible PE without establishing sufficiently high pretest probability for VTE using a scoring system like the Wells score and a D-dimer measurement.
2. Do not perform chest radiographs in patients without pulmonary symptoms as part of routine examinations.
3. Adhere to clinical practice guidelines to determine the frequency and duration of radiographic surveillance for evaluation of indeterminate pulmonary nodules. For example, discontinue radiographic surveillance if there has been no growth of a solid nodule over a 2-y period; avoid more frequent CT scans than the intervals suggested by the Fleischner Society guidelines.
4. Do not perform CT scan screening for lung cancer among low-risk patients in whom the risk-benefit ratio of screening has been shown to be unfavorable.
5. Do not perform frequent spirometry in patients with COPD in patients who are clinically stable and have an established diagnosis.
6. Do not offer pharmacologic treatment with advanced vasoactive agents approved only for the management of group I pulmonary arterial hypertension to other patients with PH (groups II-V).
7. For patients discharged on supplemental home oxygen following hospitalization for an acute illness, reassess the patient with the goal of discontinuing the oxygen if it is no longer needed or adjusting the required flow rates during rest, exertion, and sleep.
8. Do not perform therapeutic bronchoscopy for atelectasis or as part of routine pulmonary hygiene for patients in the ICU or patients with neuromuscular disorders.
9. Do not perform mediastinoscopy as the initial test for invasive staging of non-small-cell lung cancer if ultrasound-directed endoscopy is available.
10. Do not routinely administer IV steroids for patients hospitalized for acute exacerbations of asthma and COPD.

PE = pulmonary embolism; PH = pulmonary hypertension.

Results

Table 2 shows our final top five list. Following the Choosing Wisely format, each item includes the recommendation and a brief supporting paragraph. Here, we elaborate on why we selected these recommendations, including the rationale for doing less, the potential harms of doing more, and the prevalence and cost of overuse.

1. Do Not Perform CT Scan Surveillance for Evaluation of Indeterminate Pulmonary Nodules at More Frequent Intervals or for a Longer Period of Time Than Recommended by Established Guidelines

Rationale: Based on observational data of the natural history of pulmonary nodules,[11] the American College of Chest Physicians and Fleischner Society have established algorithms to evaluate pulmonary nodules (parenchymal lesions ≤ 3 cm) that are indeterminate (not yet known to be malignant or benign).[12,13] The algorithms take into account both the patient's cancer risk factors and the nodule size in the recommended frequency and duration of CT scan surveillance. There is no evidence that monitoring nodules more often or for a longer duration than recommended improves outcomes such as resectability or mortality of lung cancer. Meanwhile, more intensive surveillance than recommended exposes patients to potential harms including unnecessary radiation (with the attendant risk of radiation-induced cancer),[14] prolonged uncertainty with attendant anxiety and distress,[15,16] increased likelihood of finding other incidentalomas that spur further workup, and the inconvenience of traveling to the medical center for unnecessary tests.

Scope of the Problem: Pulmonary nodules are detected in hundreds of thousands of Americans each year.[17] These numbers will only rise with the increasing use of CT scans for a variety of indications, including lung cancer screening.[18] A cohort study in the Veterans Health Administration system showed that nonconcordance with guidelines for nodule evaluation is common (45%): Approximately 20% of patients received more intensive nodule evaluation, with several cases of surveillance extended well beyond the recommended 2-year duration (up to 16 CT scans over 8.5 years).[19] Although the per unit cost of an extra CT scan may be small (roughly $1,400-$1,800),[20] the aggregate costs of excessive radiographic surveillance are high.[21]

2. Do Not Routinely Offer Pharmacologic Treatment With Advanced Vasoactive Agents Approved Only for the Management of Pulmonary Arterial Hypertension to Patients With Pulmonary Hypertension Resulting From Left Heart Disease or Hypoxemic Lung Diseases (Group II or III Pulmonary Hypertension)

Rationale: The evidence supporting the use of advanced vasoactive agents (eg, prostanoids, phosphodiesterase inhibitors, endothelin antagonists) for pulmonary hypertension arises primarily from studies of patients with pulmonary arterial hypertension.[22] There is no consistent evidence that these agents confer clinical benefits in other types of pulmonary hypertension. Although small studies of sildenafil for pulmonary hypertension due to left heart disease have suggested mild improvements in a variety of hemodynamic, exercise capacity, and quality-of-life end points,[23-25] a subsequent trial of 216 patients with heart failure and

Table 2—*Final Top Five List Approved by Societies' Leadership and Included in Choosing Wisely Campaign*

Top Five
1. Do not perform CT scan surveillance for evaluation of indeterminate pulmonary nodules at more frequent intervals or for a longer period of time than recommended by established guidelines. Clinical practice guidelines for pulmonary nodule evaluation (such as those issued by the Fleischner Society or the American College of Chest Physicians) suggest that intensity of surveillance should be guided by the likelihood of malignancy. In patients with no prior history of cancer, solid nodules that have not grown over a 2-y period have an extremely low risk of malignancy (although longer follow-up is suggested for ground-glass nodules). Similarly, intensive surveillance (eg, repeating CT scans every 3 mo for 2 y or more) has not been shown to improve outcomes such as lung cancer mortality. Meanwhile, extended or intensive surveillance exposes patients to increased radiation and prolonged uncertainty.
2. Do not routinely offer pharmacologic treatment with advanced vasoactive agents approved only for the management of pulmonary arterial hypertension to patients with PH resulting from left heart disease or hypoxemic lung diseases (group II or III PH). Evidence and clinical practice guidelines have not established benefits of vasoactive agents (eg, prostanoids, phosphodiesterase inhibitors, endothelin antagonists) for patients with PH resulting from left heart disease or hypoxemic lung diseases. Moreover, the use of these agents may cause harm in certain situations and incurs substantial cost and resource utilization. Patients should be carefully assessed (including at a minimum right-sided heart catheterization, echocardiography, chest CT scan, 6-min walk test, and pulmonary function testing) to confirm that they have symptomatic pulmonary arterial hypertension prior to having approved agents initiated.
3. For patients recently discharged on supplemental home oxygen following hospitalization for an acute illness, do not renew the prescription without assessing the patient for ongoing hypoxemia. Hypoxemia often resolves after recovery from an acute illness, and continued prescription of supplemental oxygen therapy incurs unnecessary cost and resource use. At the time that supplemental oxygen is initially prescribed, a plan should be established to reassess the patient no later than 90 d after discharge. Medicare and evidence-based criteria should be followed to determine whether the patient meets criteria for supplemental oxygen.
4. Do not perform chest CT angiography to evaluate for possible PE in patients with a low clinical probability and negative results of a highly sensitive D-dimer assay. Clinical practice guidelines for PE indicate that the cost and potential harms of CT angiography (including radiation exposure and the possibility of detecting and treating clinically insignificant pulmonary emboli with anticoagulation) outweigh the benefits for patients with a low pretest probability of PE. In patients with a low clinical prediction score (eg, Wells or Geneva score) followed by a negative D-dimer measured with a high sensitivity test (eg, ELISA), PE is effectively excluded and no further imaging is indicated for PE evaluation.
5. Do not perform CT scan screening for lung cancer among patients at low risk for lung cancer. Low-dose chest CT scan screening for lung cancer has the potential to reduce lung cancer death in patients at high risk (ie, individuals aged 55-74 y with at least a 30-pack-y history of tobacco use, who are either still smoking or quit within the past 15 y). However, CT scan screening for lung cancer also has the potential to cause a number of adverse effects (eg, radiation exposure, high false-positive rate, harms related to downstream evaluation of pulmonary nodules, overdiagnosis of indolent tumors). Thus, screening should be reserved for patients at high risk of lung cancer and should not be offered to individuals at low risk of lung cancer.

ELISA = enzyme-linked immunosorbent assay. See Table 1 legend for expansion of other abbreviations.

preserved ejection fraction showed no benefits and a trend toward harm.[26]

Meanwhile, several other studies in which advanced vasoactive agents were administered to patients with group II or III pulmonary hypertension have confirmed the potential for harm. A trial of 471 patients with pulmonary hypertension due to severe left ventricular dysfunction was stopped early because of a trend toward increased mortality related to worsened pulmonary edema among patients randomized to epoprostenol.[27] Advanced vasoactive agents can worsen hypoxemia among patients with group III pulmonary hypertension, as shown in a study of epoprostenol for idiopathic pulmonary fibrosis[28] and in studies of sildenafil and bosentan for COPD.[29,30]

Although some experts believe that certain carefully selected patients with group II or III pulmonary hypertension behave more like pulmonary arterial hypertension (eg, patients with mitral stenosis whose pulmonary pressures have not improved despite valve replacement; patients whose pulmonary arterial pressures are elevated "out of proportion" to the underlying lung disease),[31,32] these cases are unusual. For example, in one study of 998 patients with COPD, 11 (1.1%) had disproportionately elevated pulmonary arterial pressures.[33] Because of the potential for harm with inappropriate use of advanced vasoactive agents, guidelines suggest these selected cases should be handled on a case-by-case basis in a pulmonary hypertension referral center.[31,32] To avoid inappropriate use, patients should undergo evaluation with right-sided heart catheterization, echocardiography, chest imaging, 6-min walk test, and pulmonary function testing to determine the presence, severity, and etiology of pulmonary hypertension prior to considering advanced vasoactive therapy.[31,32,34,35]

Scope of the Problem: With rising use of echocardiography, the detection of pulmonary hypertension has increased substantially in recent years.[36] However, most cases are due to left heart disease or hypoxemic lung disease rather than pulmonary arterial hypertension.[35,37] Although data on the frequency of inappropriate use of advanced vasoactive agents are sparse, one case series found that 57% of patients (24 of 42) started on advanced vasoactive medications prior to referral to

a pulmonary hypertension center did not meet guideline criteria for their use.[38] The economic burden of overuse is considerable, with annual per-patient costs estimated at $10,000 to $60,000 for oral regimens and $70,000 to $100,000 for prostanoids.[32,39-42]

3. For Patients Recently Discharged on Supplemental Home Oxygen Following Hospitalization for an Acute Illness, Do Not Renew the Prescription Without Assessing the Patient for Ongoing Hypoxemia

Rationale: Hypoxemia associated with an acute illness often resolves within days to weeks. Between 30% and 50% of patients prescribed home oxygen during an acute illness no longer meet criteria when reassessed 2 months to 3 months later.[43,44] Although there is no known benefit to supplemental oxygen for individuals with an oxygen saturation > 88%, there are potential harms. In addition to the possible harms of oxygen toxicity, patients face decreased mobility, social stigma, irritation of the nasal mucosa, and inconvenience, and are at heightened risk of falls (due to entanglement in tubing) and fires (particularly if a smoker is in the home).[45] Moreover, patients who had their home oxygen discontinued after a 2-month assessment showing they no longer met criteria had no significant decrement in health-related quality of life compared with those who continued oxygen without reassessment.[43] The need for continued home oxygen should, therefore, be reassessed no later than 90 days after the initial prescription, during a time of clinical stability.[46]

Scope of the Problem: In 2009, Medicare spent $2.15 billion on home oxygen.[47] The use of home oxygen has almost doubled over the past decade, and by 2008, 5% of Medicare Part B beneficiaries were receiving home oxygen.[47] Although it is unknown what percentage of these patients met criteria for supplemental oxygen, 35% to 65% of patients prescribed home oxygen during an acute hypoxemic event do not have the need for oxygen reassessed in a timely fashion.[48]

4. Do Not Perform Chest CT Angiography to Evaluate for Possible Pulmonary Embolism in Patients With a Low Clinical Probability and Negative Results of a Highly Sensitive D-Dimer Assay

Rationale: The pretest probability of pulmonary embolism (PE) can be calculated using simple clinical prediction tools such as the Wells or Geneva scores (free calculators at www.mdcalc.com). Multiple studies have shown that among patients with a low clinical probability of PE and a negative D-dimer (by highly sensitive assay), clinically important PE is essentially excluded.[49,50] For example, in the Christopher study,[51] 1,057 patients with a Wells score consistent with "PE unlikely" (ie, Wells score ≤ 4) and a negative D-dimer (≤ 500 ng/mL) were observed without anticoagulation for 3 months. Only five patients (0.5%) presented clinically in the next 3 months with a VTE, none of which was fatal. Thus, guidelines conclude CT pulmonary angiography is unnecessary among patients with a low probability of PE and a negative D-dimer.[52-54]

There are harms associated with overuse of CT pulmonary angiography. Patients are exposed to needless radiation, with the attendant risks of radiation-induced cancers,[14] and to contrast administration, with the attendant risks of kidney injury and anaphylactoid reactions.[55-57] Patients with a low clinical probability of PE, a negative D-dimer test or both who nonetheless undergo CT pulmonary angiography are more likely to have either an incidental finding necessitating further testing[58] or an isolated subsegmental PE of unclear significance[59] identified than a more central PE. Although isolated subsegmental emboli may be clinically insignificant, they are typically treated with anticoagulation, exposing patients to the risks of bleeding.[60] At the population level, there is evidence that overuse of CT pulmonary angiography has led to overdiagnosis and overtreatment of clinically insignificant PE, with rising harms associated with anticoagulation of these patients.[61]

Scope of the Problem: Data from multiple health maintenance organizations show CT pulmonary angiography use rose 14-fold from 0.3 to 4.0 per 1,000 beneficiaries between 2000 and 2008.[62] These CT scans are often performed in patients who do not meet criteria for testing. For example, in one multicenter study, 55% of CT pulmonary angiograms were performed on patients with a low likelihood of PE based on Geneva scores, D-dimer testing, or both.[63] Another multicenter study found the mean number of CT pulmonary angiograms performed per confirmed PE in the United States was 7.6 (vs 1.5 in Europe where CT scanning was reserved for patients with a higher likelihood of PE).[64] Costs associated with CT pulmonary angiography are high (on average, $5,400 per scan, as compared with $1,400-$1,800 for other chest CT scans and $370 for chest radiograph).[20]

5. Do Not Perform CT Scan Screening for Lung Cancer Among Patients at Low Risk for Lung Cancer

Rationale: The strongest evidence supporting low-dose CT scanning for lung cancer screening comes from the National Lung Screening Trial (NLST), which showed a 20% reduction in lung cancer death among individuals randomized to annual CT scan screening.[18] The NLST enrolled individuals aged 55 to 74 years with at least 30 pack-years of tobacco use, who were

either current smokers or had quit smoking within the past 15 years. Subsequent modeling studies suggest that the greatest benefit was derived among the highest-risk patients within the NLST population.[65] By contrast, there is no evidence that individuals at low risk of lung cancer derive any benefit from CT scan screening. Although clinical practice guidelines differ in the recommended high-risk population for screening, no guideline recommends screening individuals with a smoking history of < 20 pack-years.[66-69]

CT scan screening for lung cancer can cause harm.[70] In the NLST, after three annual screening CT scans, 39% of patients had an abnormal finding (mostly pulmonary nodules) that led to further evaluation and 8% had extrapulmonary incidentalomas.[18] Although 96% of these findings turned out to be false positives, evaluating these findings exposes patients to anxiety and distress,[15,16] radiation for those who undergo surveillance,[14] and possible physical complications among those who undergo biopsy.[71,72] Even when screening identifies a cancer, overdiagnosis of a clinically insignificant tumor is possible; it has been estimated that 13% to 27% of screen-detected lung cancers are so indolent that they may be clinically unimportant.[73-75]

Scope of the Problem: The prevalence of CT scan screening for low-risk individuals is unknown. Since the US Preventative Services Task Force only recently recommended low-dose CT scan screening for lung cancer,[69] most insurance agencies did not previously cover screening CT scans. Regardless, many hospitals market CT scan screening directly to consumers and do not consistently target only individuals at high risk of lung cancer.[76] One rationale for our recommendation against screening low-risk individuals is to help prevent this practice from becoming prevalent.

Discussion

The problem of excessive use of tests and treatments with low value to improve health in the United States has long been recognized.[2] Many solutions have been proposed; few have succeeded at reining in rising costs. The Choosing Wisely campaign differs from past efforts in that physicians themselves are leading the way by identifying overused tests and treatments that may be doing more harm than good for patients at great expense to the health-care system.

Rather than dictating how clinicians care for all patients, Choosing Wisely aims to improve dialogue between clinicians and patients, with a goal of shifting routine care away from aggressive, expensive choices that are not supported by evidence. Although the recommendations in our top five list will not apply to every patient in the circumstances we have described, we carefully selected five scenarios in which the evidence supports the conclusion that "less is more" for most patients. When confronted with the scenarios we have described, clinicians should carefully consider and discuss our recommendations with patients rather than simply proceeding with testing or treating. Although some clinicians may worry that not ordering a test (eg, to look for cancer or PE) may lead to a lawsuit if the patient is later diagnosed with the condition, studies show that physicians who have communicated clearly and openly with patients are less likely to be sued.[77-79]

A key issue is how to conduct these potentially challenging conversations. Some clinicians are concerned that patients will resist the Choosing Wisely recommendations, seeing them as a form of rationing. Modern patients, who have access to medical information from the plethora of Internet health sites and the barrage of direct-to-consumer pharmaceutical advertising, may come to appointments with particular tests or treatments in mind. Rather than taking the easier route of simply acquiescing to the patient's request,[80] we hope that pulmonologists and other affected clinicians will use our recommendations to engage patients in a frank discussion about the merits of more conservative approaches. To further this goal, the ABIM and Drexel University developed physician communication modules with examples of how to discuss Choosing Wisely recommendations, and *Consumer Reports* created patient education pages explaining why the tests and treatments on Choosing Wisely top five lists may not be right for them.[10]

Of course our recommendations will have little impact if word is not spread. Of note, the top five lists for adult pulmonary medicine and critical care medicine were the only two lists produced through multisociety collaborations; the adult pulmonary top five list should reach a particularly broad audience with the help of both the ATS and American College of Chest Physicians in disseminating our recommendations. We have begun to disseminate our top five list through a variety of forums: open sessions at the ATS and CHEST 2013 conferences to garner feedback on our recommendations; press releases to both the lay and medical communities; links to the top five list from the ATS and American College of Chest Physicians websites; and publication of this manuscript, with companion pieces planned in the *American Journal of Respiratory and Critical Care Medicine* and the *Annals of the American Thoracic Society*. We encourage ATS and American College of Chest Physicians members to spread the word to patients and colleagues alike.

The process used to create our top five list has limitations. First, because Choosing Wisely is designed as an effort led by physicians for physicians, our task force did not include a patient representative and thus may not represent their views. Second, a task force composed of different members with different areas of

expertise may have produced a different list. However, our top five recommendations performed well on prespecified scoring criteria and were deemed appropriate by external content experts and the ATS and American College of Chest Physicians leaderships. Thus, while we believe each included item is meritorious, we acknowledge that other items not on this list could also represent important opportunities for improving the value of pulmonary medicine. Third, weak evidence bases regarding the benefits, harms, and cost-effectiveness of many tests and treatments commonly used in pulmonary medicine (eg, steroids for a variety of conditions) limited the range of topics we could consider. We have begun discussions with the American College of Chest Physicians leadership to create guidelines on how to conduct rigorous cost-effectiveness research, which we hope will strengthen the evidence base and help guide future efforts to identify low-value care in adult pulmonary medicine.

Moving forward, it will be important to examine whether implementation of our recommendations achieves their intended purpose: to reduce wasteful spending in adult pulmonary medicine without adversely affecting patient outcomes. An analysis of the first three top five lists released (all related to primary care) showed that if those recommendations were uniformly implemented in the United States, > $6 billion could be saved.[81] We hope that future research will explore the potential or actual impact of the recommendations we have made for adult pulmonary medicine.

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