Delays in Diagnosis: Barriers to Efficient and Accurate Pulmonary Evaluation

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CHEST Clinical Perspectives™

Introduction

Treatment delays for pulmonary diseases significantly impact patient outcomes. A large percentage of patients with chronic obstructive pulmonary disease (COPD), lung cancer, and interstitial lung disease (ILD) have their disease misdiagnosed and may not receive appropriate treatment for months, or even years.[1-3] One of the contributing factors is that patients often present with common symptoms, including shortness of breath and cough, and these symptoms are often mistaken for common conditions such as asthma.[4,5] Another factor is a lack of knowledge about these diseases among the health-care providers who initially assess many of these patients.[4,5]

Failure to recognize the signs and symptoms of specific pulmonary diseases may result in multiple visits and subspecialty referrals and the administration of ineffective, inappropriate, or potentially harmful treatment.

BACKGROUND AND PURPOSE

In this *Clinical Perspectives*™ issue, CHEST is undertaking primary research with pulmonologists to understand barriers to timely diagnosis of pulmonary diseases. Delays in diagnosis have become common in pulmonary medicine due to a variety of patient, provider, and health system factors.
The objectives of this research are to:

- Understand pulmonologist's definition of and experience with delays in pulmonary diagnoses.
- Assess perceptions of the prevalence of delays in pulmonary diagnoses.
- Assess prevalence of factors contributing to delays in pulmonary diagnoses, both at general and condition-specific levels.
- Prioritize actions for reducing delays in diagnoses.

METHODOLOGY

CHEST conducted an online survey with a sample of n=106 pulmonologists randomly selected from the CHEST member database. Respondents were sent a link to the survey from CHEST, and data were collected during September 19-24, 2018.

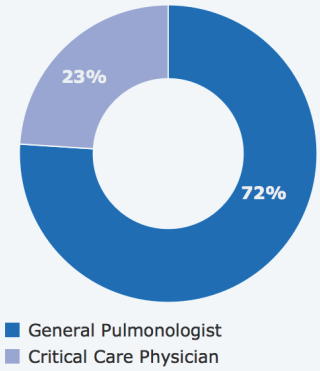
Descriptive statistics were used to assess distributions of the data across important behavioral variables. Inferential statistics were used to assess differences in descriptive and behavioral measures, which were cross-tabulated with patient volume and practice setting data. Depending on data type, a 2-tailed independent samples t-test and a chi-square test were used to test for statistical significance ($P < .1$ considered statistically significant).

RESPONDENT PROFILE

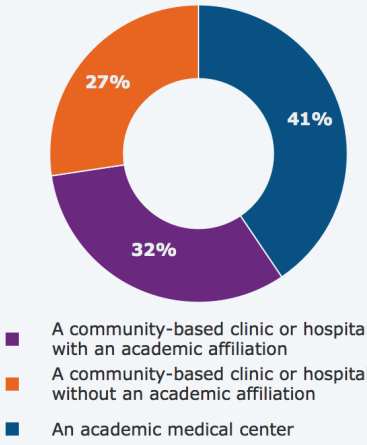
The majority of the respondent base comprises general pulmonologists (72%). More than half of respondents (59%) are practicing in community-based settings, either with (32%) or without (27%) an academic affiliation. The remainder (41%) are practicing at an academic medical center. The respondent base comprises an even mix of clinicians by tenure, with 49% reporting up to 10 years post-fellowship clinical practice experience, and 51% reporting practice tenure in excess of 10 years. Most respondents describe their practice location as primarily urban (64%) or suburban (28%).

Respondent Profile

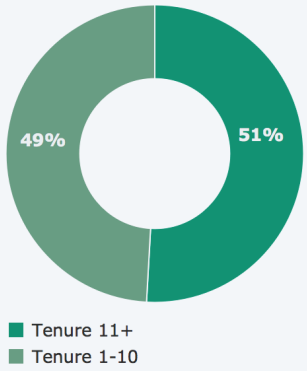
Specialty



Practice Setting



Years in Practice



Geography of Practice Setting

Q: What is your specialty?

Q: What is your primary medical affiliation?

Q: How many years have you been in practice since completing your fellowship?

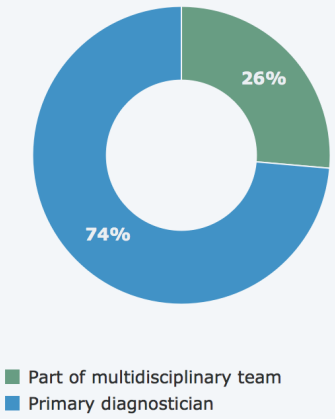
Q: What setting best describes the area in which you practice?

CLINICAL ROLE IN PULMONARY DIAGNOSIS

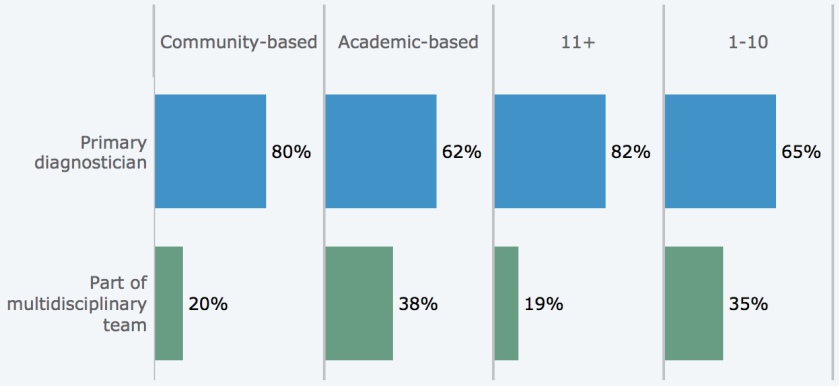
The majority of pulmonologists are the primary diagnostician for patients with pulmonary symptoms.

Three-fourths of respondents (74%) say they are the primary diagnostician when it comes to evaluation of pulmonary symptoms in the patients they see. A fourth (26%) indicates that they work as part of a multidisciplinary team when it comes to symptom evaluation. Reported clinical role varies by tenure and practice setting: respondents in community-based settings are more likely to say they function as the primary diagnostician (80% vs 62% among their academic-based colleagues), as do clinicians who have been in practice post-fellowship for more than 10 years (82% vs 65% among those with tenures of 10 years or less).

Diagnostic Approach to Pulmonary Symptoms



Diagnostic Approach by Setting and Tenure



Q: Thinking about the patients you see for evaluation of pulmonary symptoms; do you primarily do the evaluation and diagnosis on your own or do you work as part of a multidisciplinary team?

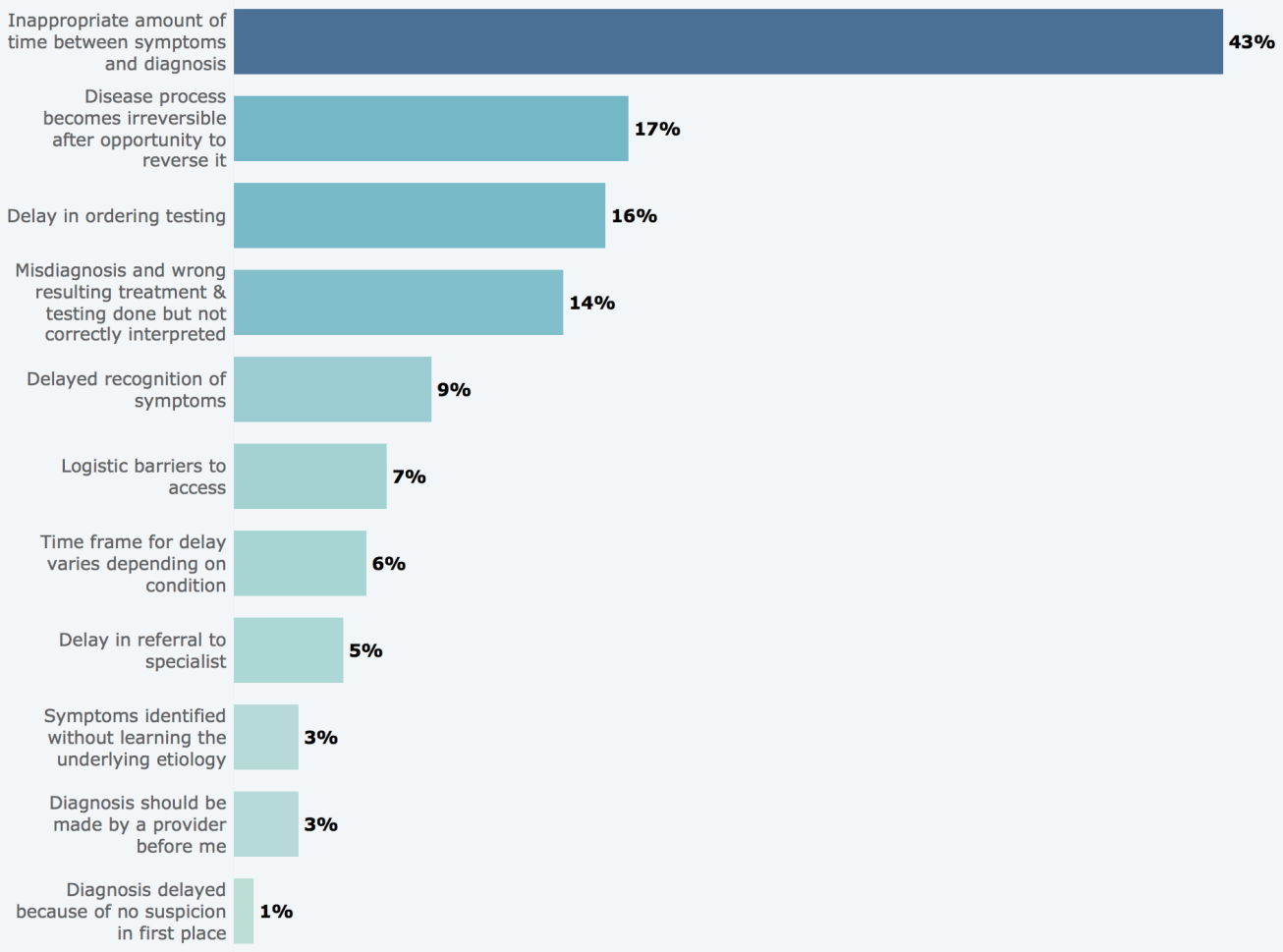
DEFINING DELAYS IN PULMONARY DIAGNOSIS

Many pulmonologists define "delay in diagnosis" relative to the amount of time between presenting symptoms and a correct diagnosis.

Respondents were asked, on an open-ended basis, to define what the terminology "delay in diagnosis" means to them within the context of their clinical practice. Not surprisingly, respondents are most apt to define the terminology as an "inappropriate" amount of time between the presentation of symptoms and establishing the correct diagnosis (43%). *Many of these respondents define delays based on certain elements of timing, eg, excessive waits for test results and excessive amounts of elapsed time to establish a diagnosis (1-3 months or longer), which varies depending on the clinical condition.*

In addition to a general sense of excessive time to diagnose, respondents also identify a variety of other factors they include in their definition of a delay, including: circumstances where the disease process becomes irreversible after an earlier opportunity existed to treat it (17%); any type of delay in ordering testing, eg, pulmonary function, chest computed tomography scans, etc (16%); misdiagnosis/misinterpretation of tests and wrong resulting treatment (14%); and any logistical barrier to access, either for testing or specialty referral (11%).

Unaided Definition of Delay in Diagnosis

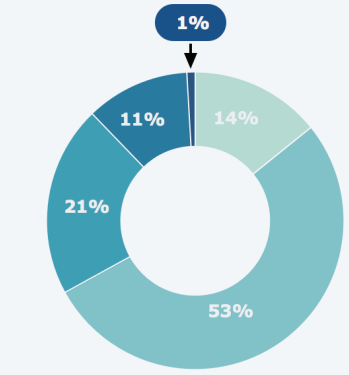


Q: In your own words, what is your definition of a delay in diagnosis when it comes to pulmonary disease?

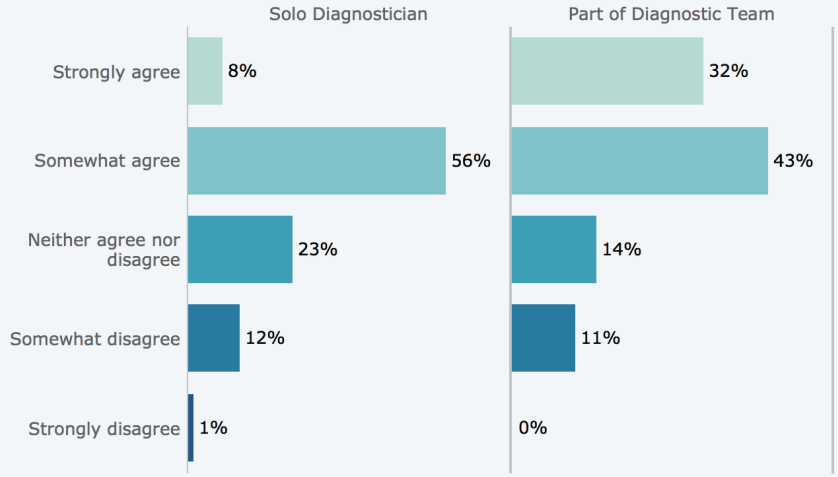
A significant minority of pulmonologists say that delays in diagnoses are not a significant issue for their patients.

To understand attitudes toward delays in diagnosis, respondents were asked to rate their level of agreement with the statement *"Delays in diagnosis are a significant issue in the patients I see for evaluation,"* using a five-point scale where a rating of "5" means strongly agree and a rating of "1" means strongly disagree. *A substantial majority of respondents either strongly agree (14%) or somewhat agree (53%) with the statement; however, a significant minority (33%) do not.* Respondents who evaluate pulmonary patients as part of a multidisciplinary team are much more likely to agree with that statement (mean agreement score of 4.0 vs 3.6 among respondents who report being the primary or sole diagnostician). Of note, there is no difference in agreement scores between respondents practicing in community-based settings vs those practicing in academic-based settings.

Significance of Delays in Diagnosis for Patient Population



Significance of Delays by Diagnostic Approach



Q: Please rate your level of agreement with the following statement: *"Delay in diagnosis is a significant issue in the patients I see for evaluation."*

Delays in diagnosis are highest among patients with ILD and notable among patients with COPD and lung cancer.

Irrespective of attitudes toward delays in diagnosis, respondents indicate that a notable portion of their patients experience delays. Prevalence in reported delays is highest among patients who are ultimately diagnosed with some form of ILD, with respondents reporting that *43% of patients ultimately diagnosed with some type of ILD experienced a delay in diagnosis* (median reported percentage). Reported delays among COPD and lung cancer patients are also notable, but somewhat less pronounced, with respondents reporting *25% of patients with COPD and 22% of patients with lung cancer experiencing delays* (mean reported percentage).

Estimated Prevalence and Length of Diagnostic Delays

	Mean Estimated Prevalence of Delay
Patients with ILD/IPF diagnosis	43%
Patients with COPD diagnosis	25%
Patients with Lung Cancer diagnosis	22%

	Mean Estimated Delay in Months
Patients with ILD/IPF diagnosis	14 months
Patients with COPD diagnosis	13 months
Patients with Lung Cancer diagnosis	4 months

Q: On average, what is your estimate of the delay in diagnosis (in months) in patients you see for evaluation that results in a diagnosis of the following conditions? Please estimate delay from the time the patient first complains of a symptom to establishing the diagnosis.

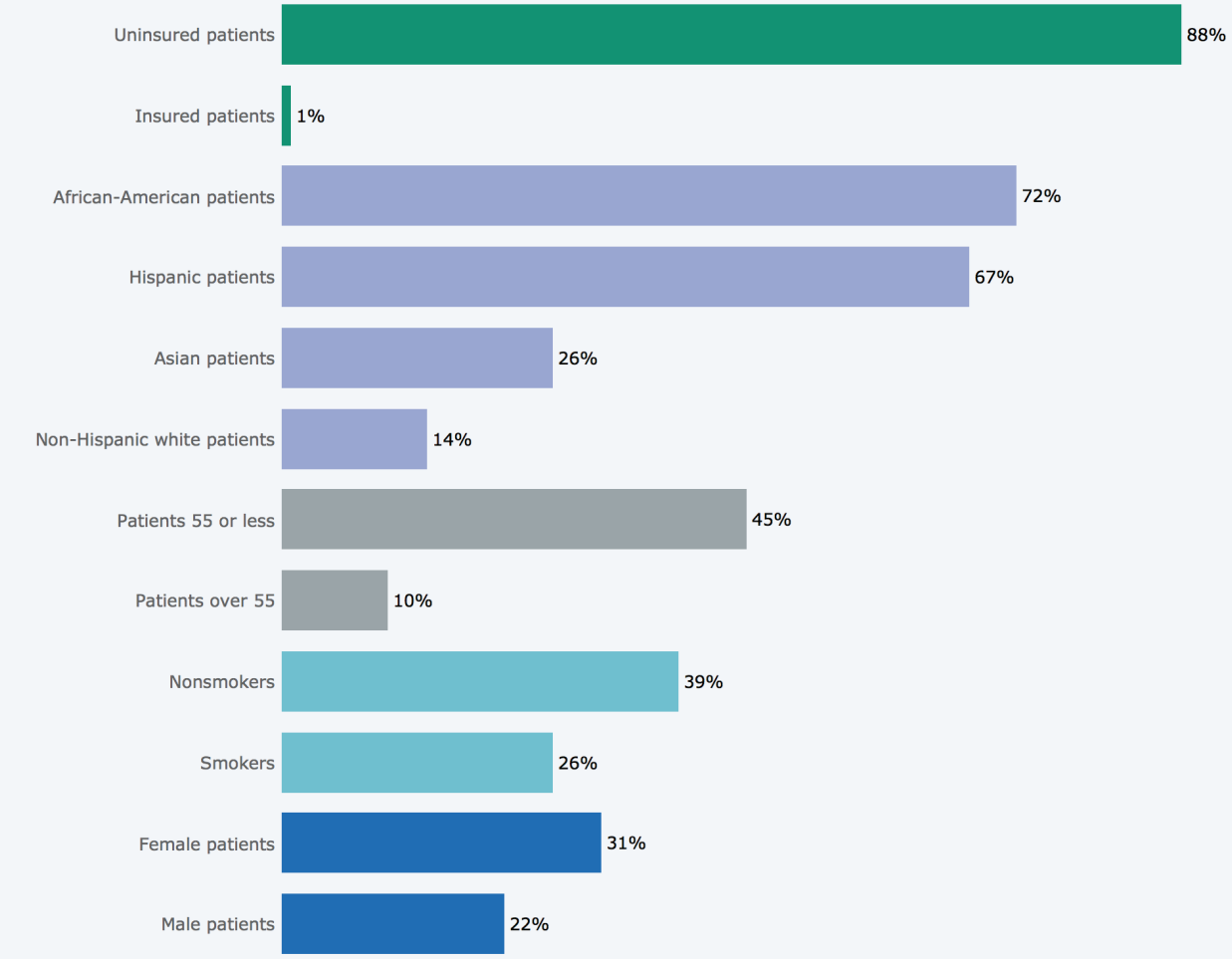
Delay lengths observed among patients do not drive attitudes toward the significance of delays.

Respondents indicate that patients ultimately diagnosed with some form of ILD experience delays of 14 months (mean reported number of months); 13 months among those diagnosed with COPD; and 4 months among patients with lung cancer. *Of note, attitudes toward the significance of delays in diagnosis do not appear to be driven by the lengths of delays observed among patients. There are no statistically significant differences in the estimated average length of delay when comparing respondents who say the issue of delays is significant in their practice compared with those who say it is not.* The duration of reported delay varies by condition.

The uninsured, African-American patients, and Hispanic patients are more likely than other groups to experience delays in diagnosis.

In the estimation of our respondents, *uninsured patients (88%), African-American patients (72%), and Hispanic patients (67%) are all considered more likely than average to experience delays in pulmonary diagnosis.* Alternatively, non-Hispanic white patients (14%), patients over the age of 55 (10%), and patients with health insurance coverage (1%) are least likely to be classified as being above average for delays in diagnosis. Other patient categories are believed to be at moderate likelihood of experiencing a diagnostic delay: nonsmokers (39%), female subjects (31%), Asian patients (26%), smokers (26%), and male subjects (22%).

Patient Categories With Above Average Likelihood of Experiencing Diagnostic Delay



Q: Based on your observations, how likely are the above categories of patients to experience a delay in diagnosis?

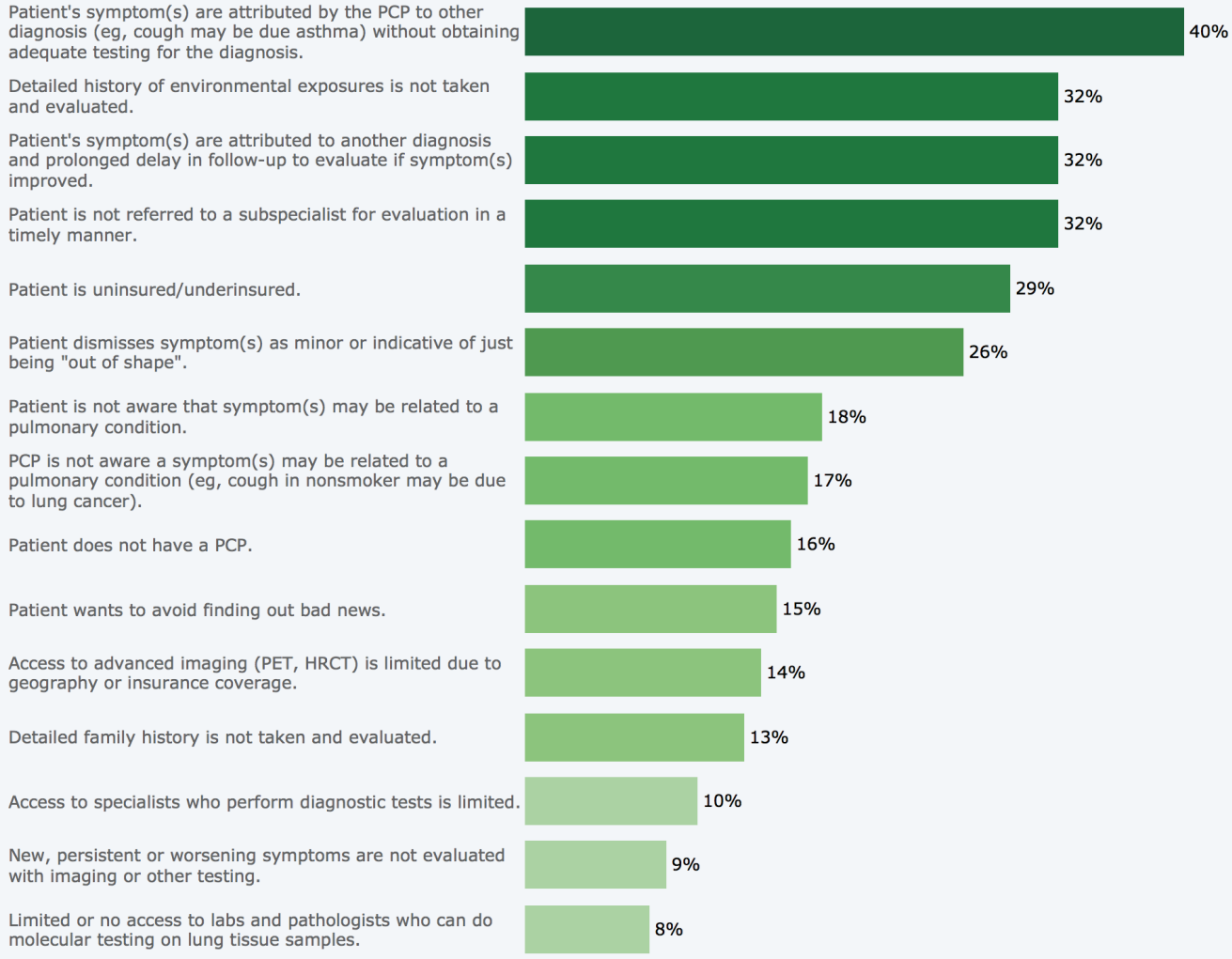
Diagnosis in primary care without adequate supportive testing is a key factor in delayed diagnosis.

Respondents were exposed to a series of factors that contribute to delays in pulmonary diagnoses and were asked to indicate the frequency with which they observe the factor in their clinical practice, eg, very frequently, somewhat frequently, or not frequently. Respondents were instructed to consider each factor on an overall basis, not with regard to a specific diagnosis. The battery of factors was developed based on a review of current literature regarding delays in pulmonary diagnoses. In addition, the Andersen Total Patient Delay Model was used to ensure that different dimensions of the clinical experience, eg, patient issues, provider issues, health system issues, were adequately represented in the battery.

Respondents are most likely to identify attribution of a symptom to a particular diagnosis by the PCP without adequate testing in support of that conclusion (40%) as the most frequent factor driving delays in pulmonary diagnosis. Other factors identified with high frequency include: failure to take and evaluate a detailed history of environmental exposures (32%); incorrect attribution of symptoms to another diagnosis with prolonged delay in follow-up because symptoms improved (32%); failure to refer to a subspecialist for evaluation in a timely manner (32%); uninsured/underinsured (29%); and patient dismissing symptom as an indication that they are just "out of shape" (26%).

Less frequently observed are patient issues, eg, lack of awareness of pulmonary symptoms (18%); and not wanting to hear bad news (15%). Knowledge and process issues in the primary care setting are mentioned with more limited frequency, eg, PCP not aware that a symptom such as persistent cough in a nonsmoker is related to a pulmonary condition (17%); and failure to take and evaluate a complete family history (14%). Access issues are also identified but not as a main driver of delays: patient not having a PCP (16%); limited access to imaging (14%); limited access to specialists for diagnostic testing (10%); and limited access to labs/pathologists who can do molecular testing on tissue samples (8%). Frequency of factors did not vary among cross-sections of respondents.

Frequency of Delay by Observed Factors



Q: Based on your experience with the patients you evaluate for pulmonary diseases and disorders as a whole, how frequently do you observe the above factors that contribute to delays in diagnosis?

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SPECIFIC DRIVERS OF DELAYS IN DIAGNOSIS FOR LUNG CANCER, COPD, AND ILD

For each of the following conditions—COPD, lung cancer and ILD—respondents were presented with a list of factors that result in delays in diagnosis and were asked to select the two most common factors based on their clinical experience. Some of the factors, eg, persistent symptoms without imaging, are common to all of these conditions, while others are specific to a particular diagnosis, eg, turnaround times for cytology and molecular testing results.

A lack of imaging studies despite persistent symptoms and a lack of patient awareness are the primary drivers of delayed diagnosis in both COPD and lung cancer; lack of primary care knowledge is the primary driver in ILD.

Interestingly, for both COPD and lung cancer, more than 40% of respondents indicate that *the top three reasons they observe for delays in diagnosis are the same: persistent symptoms without imaging studies; patients not being aware that symptoms are related to a pulmonary condition; and misattribution of symptoms to a diagnosis without adequate diagnostic testing.*

Beyond these commonalities, drivers of delays vary by condition. Respondents indicate that misattribution of symptoms and delayed follow-up because of symptom improvement, presence of one or more pulmonary diagnoses, lack of PCP awareness, and initial false-negative chest radiographic results are identified as drivers. Interesting, delays related to the diagnostic process typically undertaken by pulmonologists, eg, turnaround for cytology test results, turnaround for molecular testing results, and access to labs/pathologists who can do molecular testing on tissue samples, are mentioned infrequently.

With regard to patients with COPD, respondents are more likely to identify new or worsening symptoms that go unchecked; lack of PCP awareness about COPD symptoms; and misattribution of symptoms with prolonged delay as secondary factors driving delay.

Drivers of Delay in Diagnosis for Lung Cancer and COPD

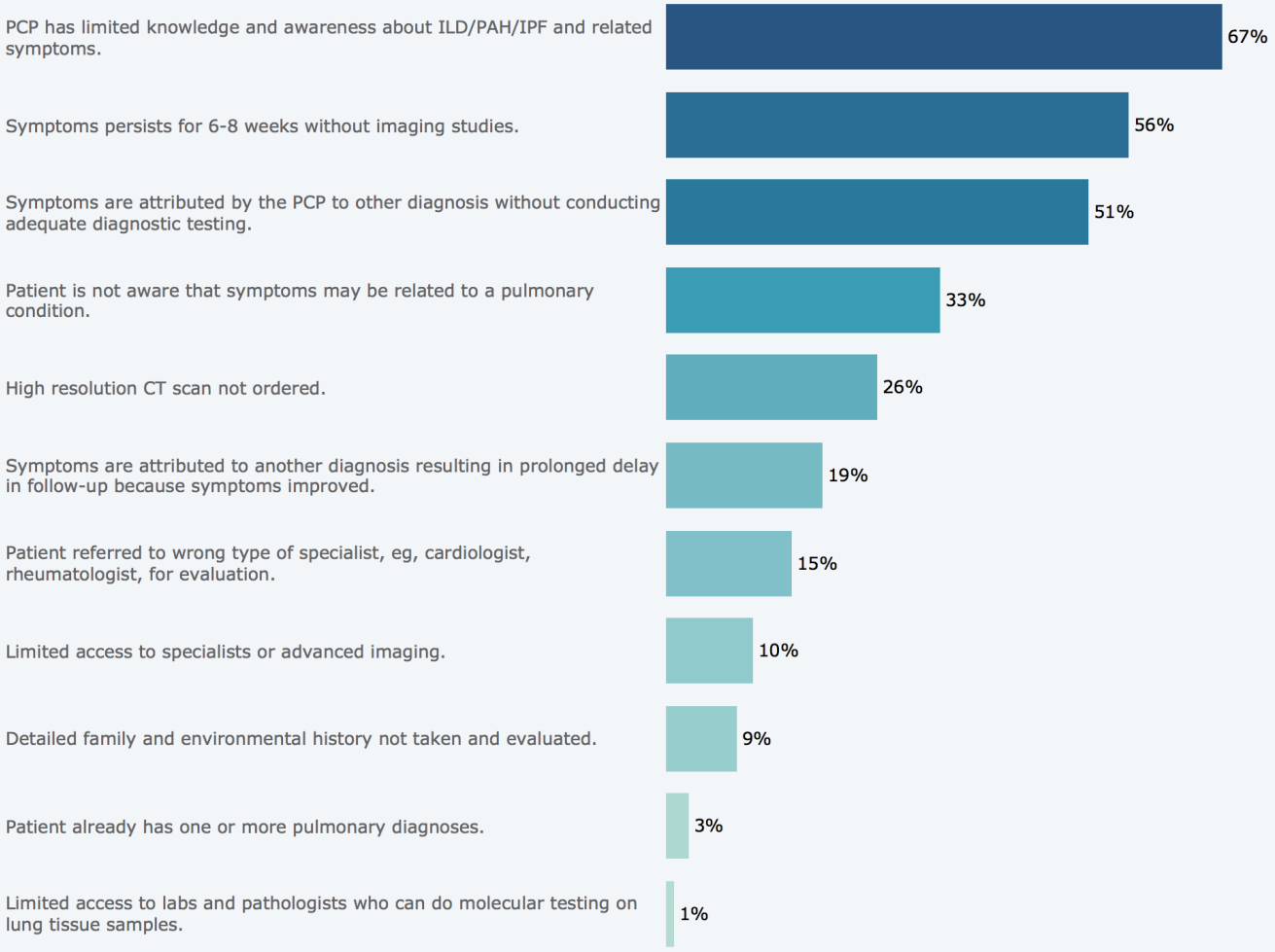
	COPD	Lung Cancer
Symptoms persist for 6-8 weeks without imaging studies & symptoms persist for 6-8 weeks without imaging studies or pulmonary function testing.	64%	66%
Symptoms are attributed by the PCP to other diagnosis without conducting adequate diagnostic testing & symptoms are attributed by the PCP to other diagnosis without conducting adequate lung cancer screening.	59%	43%
Patient is not aware that symptoms may be related to a pulmonary condition.	46%	46%
New or worsening symptoms go unchecked.	39%	
PCP is not aware that symptoms may be related to COPD & PCP is not aware that symptoms may be related to lung cancer.	36%	27%
Symptoms are attributed to another diagnosis with prolonged delay in follow-up because symptoms improved.	27%	43%
Patient already has one or more pulmonary diagnoses.	10%	30%
Limited access to specialists or advanced imaging.	8%	7%
Detailed family and environmental history not taken and evaluated.	2%	2%
Slow turnaround for molecular testing results.		1%
Slow turnaround for cytology results.		2%
Patient had an initial false-negative chest x-ray, eg, diagnosis of pneumonia or no suspicion of cancer.		18%
Limited access to labs and pathologists who can do molecular testing on lung tissue samples.		2%
Initial chest CT scan shadows diagnosed as benign tumors or inflammation.		8%

Q: Thinking specifically about patients for whom you have **diagnosed lung cancer/COPD** during the past month who likely experienced a delay in diagnosis, in your opinion, what were the three most common reasons for that delay?

Limited PCP knowledge is the most common driver of delayed diagnosis in ILD.

Drivers of delays for establishing an ILD diagnosis are somewhat different. *Limited PCP knowledge is mentioned by 67% of respondents as one of the most common reasons for delaying accurate diagnosis.* Similar to other conditions, persistent symptoms and misattribution of symptoms are also significantly identified. Other factors unique to this condition are also identified, including failure to order high-resolution CT scanning and referral to the wrong type of specialist.

Drivers of Delay in Diagnosis for ILD



Q: Thinking specifically about patients for whom you have **diagnosed some form of interstitial lung disease** during the past month who likely experienced a delay in diagnosis, in your opinion, what were the three most common reasons for that delay?

PCP education is considered the most effective intervention to reduce delays in diagnosis.

Respondents were presented with a list of actions to take in order to reduce delays in diagnosis of pulmonary diseases and were asked to rank them in order in terms of their potential impact. Consistent with their assessment of factors driving delays in diagnosis, *the highest-ranking actions center around PCP education, including: improved PCP education regarding the spectrum of lung diseases; education of PCPs regarding appropriate testing algorithms for patients with respiratory symptoms; and better understanding and recognition of clinical signs and symptoms of different pulmonary diseases*.

Activities directed at patients, including a public health campaign to educate high risk audiences about pulmonary symptoms and potential delays in diagnosis and patient education about pursuing medical care when symptoms persist or worsen are ranked as having the least potential impact.

Ranking of Tactics to Reduce Diagnostic Delays

	Mean Rank Scores
Improve education of PCPs, NPs, and PAs regarding spectrum of lung diseases: eg, lung cancer in nonsmokers and light smokers, worsening symptoms in patient with COPD may herald another disease.	2.8
Education of PCPs, NPs, and PAs regarding appropriate testing algorithms for patients with respiratory symptoms, eg, if suspect COPD or asthma, obtain PFTs; if symptoms persist or worsen, obtain CXR, etc.	3
Better understanding and recognition of clinical signs and symptoms of different pulmonary diseases.	3.1
Better protocols for PCPs and specialists to use regarding evaluation of worsening or improving pulmonary symptoms.	3.5
Public health campaign to educate high risk audiences about pulmonary symptoms and potential delays in diagnosis.	4.2
Patient education regarding reasons to pursue medical care when symptoms persist or worsen.	4.4

Lower score means that items are ranked higher by respondents.

Q: Please RANK the above actions in terms of the impact they would have on reducing delays in diagnosis of pulmonary diseases and disorders. (1=greatest impact and 6=least impact).

KEY TAKEAWAYS

Key Takeaways

- Pulmonologists' definition of delay in diagnosis is based primarily on time from symptoms to correct diagnosis.
- Pulmonologists working as part of a multidisciplinary team are more attuned to aspects of delay in diagnosis.
- Uninsured, African-American, Hispanic, nonsmoking, and female patients are more likely to experience a delay in diagnosis.
- A core set of factors relating to primary care knowledge and practice drives delays and failure to order appropriate diagnostic testing is a key barrier to timely diagnosis.
- Factors explaining delays in diagnosis related to COPD and lung cancer are similar and include: persistent symptoms without imaging studies; patients not being aware that symptoms are related to a pulmonary condition; and misattribution of symptoms to a diagnosis without adequate diagnostic testing.
- Factors driving delays in correctly diagnosing ILD are somewhat different and include limited clinician knowledge of the condition and diagnostic workup.

A significant minority of pulmonologists say that delays in diagnoses are not a significant issue in the patients they see for evaluation. Attitudes toward the significance of delay do not appear to be impacted by the actual estimated length of delay—both pulmonologists who say that delays are a significant issue and those who don't report similar estimated lengths of delay among the patients they see for evaluation.

DISCUSSION

Diagnostic delays may be more the norm than the exception among patients with pulmonary diseases, such as COPD, lung cancer, and ILD. Lamprecht et al[1] reported an average underdiagnosis rate of 81% among patients with COPD (N=30,874 in 44 countries.) Gildea et al[2] showed that >90% of patients had a 5- to 6-month delay before receiving a definitive diagnosis of lung cancer in an insurance claims database study. Patients with PAH experience, on average, had a delay from 1 to 4 years after onset of symptom.[6,7] Deano et al[3] showed that more than 60% of patients referred for evaluation and management of PAH presented with WHO FC III or IV symptoms at the time of diagnosis.[3]

The reasons for delay are varied. In COPD, the literature strongly supports a lack of awareness and knowledge about COPD among health-care providers as an important factor in misdiagnosis and/or delays in diagnosis.[5] Contributors to the delay include underutilization of lung function measurements and the nonspecific nature of the symptoms. COPD is often not recognized until late in the disease process, and many patients do not receive a diagnosis of COPD until a severe exacerbation requires hospitalization.[8,9] A late diagnosis of COPD represents a missed opportunity to modify the course of the disease through evidence-informed risk factor management and treatment,[10,11] and patients have a poorer prognosis when COPD is diagnosed at later stage.[12]

In lung cancer, most patients experience long periods of delay between their first diagnostic test for lung cancer and a definitive diagnosis. Contributors to delay include a lack of symptoms in early stages and the fact that some lung cancers, particularly adenocarcinomas, are slow growing.[13,14] The stage at which lung cancer is diagnosed is a key factor in a patient's prognosis. A late diagnosis represents a missed opportunity for treatment and worse outcomes, including higher risk of mortality and increased health-care costs.[13]

Interstitial lung diseases are diagnostically challenging because signs and symptoms are similar to a wide range of respiratory conditions. Early diagnosis is further complicated by the nonspecific nature and gradual onset of initial symptoms, which patients often initially attribute to age or being out of shape. Cosgrove et al[15] recently reported that 43% of respondents in the INTENSITY survey reported a delay of ≥ 1 year, and 19% reported a delay of ≥ 3 years. Studies evaluating diagnostic agreement among pulmonologists, radiologists, and pathologists have reported only modest interobserver agreement, even among expert observers.[16-18] Delays in diagnosis are especially grave for patients with ILD. Reductions in forced vital capacity as small as 5% to 10% over 6 months are associated with a significant increase in the risk

of death,[19-24] and delayed referral to subspecialty care has been shown to confer an increased risk of death in patients with IPF.[25] Additionally, delays in diagnosis can delay evaluation for lung transplantation, potentially causing loss of eligibility due to advanced age or frailty. Finally, misdiagnosis may carry the risk of exposure to ineffective or harmful therapies.[15]

Given the impact that delays in diagnosis have on treatment and patient outcomes, it is important to understand what practices impede diagnosis and how to reduce barriers and shorten the time to correct diagnosis.

For the most part, pulmonologists have a common definition of what constitutes a delay in diagnosis that largely centers around time from symptoms to attribution. From the standpoint of definition, as well as experience with the prevalence and length of delays, there are no variations among key cross sections of respondents (academic vs community and by tenure).

The approach to the diagnostic process appears to have some impact on perceptions of delay. Individuals who diagnose pulmonary diseases as part of a multidisciplinary team are more likely to report seeing patients who have experienced a delay and, in turn, consider delays to be a significant factor among their patients. Respondents working as part of a multidisciplinary team are more likely to report higher percentages of patients who have experienced a delay, even though the reported length of the delay does not vary in comparison to solo diagnosticians. This is not an academic-community setting divide—attitudes toward delay are not impacted by setting or tenure. Some pulmonologists, however, appeared to be more tuned into the issue of delays in diagnosis. They are more likely to report higher percentages of their patients experiencing delays even though the estimated length of the delay is no different than that reported by pulmonologists who express less concern.

There is widespread agreement that certain patient populations are at far greater risk for experiencing delays in diagnosis. Consistent with much of the published literature on this topic, uninsured/underinsured, African-American, Hispanic, nonsmoking, and female patients are observed as being more likely to experience a delay in diagnosis based on the patient populations of these respondents.

There is a consistent core set of factors that drives delays, almost irrespective of the final determined diagnosis and, most frequently, respondents identify primary care as a point of concern. At the top of the list is the failure to order appropriate diagnostic testing, eg, PFT or chest radiography, in a timely manner for patients presenting with a respiratory complaint. Misattribution and subsequent improvement of symptoms, is also identified as a major delay factor. For the most part, access factors (to a PCP and to appropriate testing) are generally considered to be lower priority issues relative to breakdowns in the initial patient encounter.

Factors explaining delays in diagnosis related to COPD and lung cancer are actually fairly similar and consistent with the overall delay factors identified by respondents. Interestingly, process factors related to tissue sampling and testing are generally not considered to be major causes of delay in diagnosis for patients with lung cancer. Factors driving delays in correctly diagnosing ILD are somewhat different. Knowledge factors among PCPs are considered to be an overwhelming driver, as is understanding of appropriate patient workup. Misdiagnosis appears to be much more significant with this condition.

EDUCATIONAL OPPORTUNITIES

Not surprisingly, pulmonologists feel that there is a significant improvement opportunity in raising knowledge and compliance with algorithm/clinical protocols among primary care physicians who are the initial point of the evaluation for patients complaining of pulmonary symptoms.

It is less clear from these data about the extent to which pulmonologists feel that their own specialty may not be measuring up as it relates to appropriate initial diagnostic actions; however, future surveys could explore this aspect of practice.

The observation that African-American, Hispanic, nonsmoking, uninsured, and female patients are more likely to experience delays in diagnosis may underscore a need for education specifically relating to these populations.

Finally, the finding that in the same circumstances, pulmonologists have a different perception regarding the significance of delay, may warrant further exploration.

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Dr. Patricia Rivera is both an educator and a clinical researcher. She is a Professor of Medicine in the Division of Pulmonary Diseases and Critical Care Medicine at the University of North Carolina at Chapel Hill (UNC). In addition, she serves as the Director of the UNC Carolina Lung Cancer Screening Clinic, the Pulmonary Function and Bronchoscopy Laboratory, and is Co-Director of the Multidisciplinary Thoracic Oncology Program.

Dr. Rivera considers the lung a "beautiful organ" and is still fascinated by it. Her special interests include care of patients with lung cancer, immunocompromised hosts, lung screen screening, novel approaches for early detection of lung cancer in high-risk patients, chemotherapy, and radiation-induced pneumonitis. Her important research has focused on lung cancer, immunocompromised patients, and fluorescent bronchoscopy.

Dr. Rivera was integral in guiding both the research and the data interpretation components of this Clinical Perspectives ™ white paper.

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