



Fellowship Education in Interstitial Lung Disease

A National Survey of Program Directors and Trainees

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ABSTRACT

Background: Whether graduating pulmonary and critical care medicine (PCCM) fellows feel adequately trained in interstitial lung disease (ILD) remains unknown. In addition, there are no published data describing the current approach to educating trainees about ILD.

Objective: To characterize the present state of ILD training during fellowship and to determine graduating PCCM fellows' perceived abilities to diagnose and manage ILD.

Methods: We surveyed PCCM fellowship program directors nationwide and compared their perceptions of graduating fellows' abilities to diagnose, provide initial management to, and offer longitudinal care to patients with ILD using a series of unpaired *t* tests. We also inquired about existing practices for educating fellows about ILD. We then surveyed graduating PCCM fellows from 19 different preselected programs to assess comfort level with ILD in comparison with other core clinical domains.

Results: Program director respondents ($n = 74$, 40% response rate) rated graduating fellows' abilities to establish specific ILD diagnoses and to provide initial management similarly (4.3 ± 0.8 on five-point Likert scale), whereas the ability to provide longitudinal expert care was rated significantly lower (3.8 ± 0.9 , $P = 0.001$). Most respondents ($n = 52$, 70.3%) reported having dedicated outpatient ILD specialists with whom fellows could rotate, but only half required this rotation. In addition, very few ($n = 17$, 23.0%) reported that a majority of patients with suspected or newly diagnosed ILD were scheduled in fellow clinics, many of whom received subsequent longitudinal care from dedicated ILD specialists. Among 71 third-year fellow respondents, confidence in managing ILD was rated poorly (3.2 ± 1.0 on a five-point Likert scale) in contrast to more common diseases like chronic obstructive pulmonary disease (4.4 ± 0.7 , $P < 0.001$) and asthma (4.2 ± 0.8 , $P < 0.001$).

Conclusion: Trainee exposure to ILD in both clinical and educational settings varied across PCCM fellowships nationwide. Fellows nearing graduation were significantly less confident in their ability to manage ILD compared with other more common pulmonary diseases.

Keywords:

interstitial lung disease; medical education; fellowship training

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Interstitial lung disease (ILD) refers to a heterogeneous group of more than 200 conditions characterized by the presence of alveolar inflammation and interstitial fibrosis (1). Among these, idiopathic pulmonary fibrosis (IPF), chronic hypersensitivity pneumonitis, connective tissue disease-associated ILD, and sarcoidosis evenly make up an estimated 80% of ILD cases in the United States (2, 3). The remaining 20% constitutes a mixture of pneumoconioses and other rarer forms of ILD, including additional idiopathic interstitial pneumonias beyond IPF (2). Establishing diagnoses of IPF and other subtypes of ILD can be challenging as their presenting symptoms (e.g., exertional dyspnea, cough, and fatigue) are often nonspecific and attributed to more common medical conditions such as chronic obstructive pulmonary disease (COPD), asthma, or pneumonia (4, 5).

Although required to identify appropriate therapies, accurate diagnoses are often preceded by considerable delays, exposure to costly and invasive diagnostic procedures, and frequent misdiagnoses in more than half of patients with ILD. For example, a recent study reported that 55% of patients received one or more alternative diagnoses before they were ultimately diagnosed with IPF or another subtype of ILD, and 19% identified at least a 3-year gap from presentation to diagnosis (6). Furthermore, many patients

experience physician delays in initiating appropriate ILD-related therapies even after acquiring an accurate diagnosis (7). Despite a paucity of education-related research in other forms of ILD, there have been multiple studies surrounding physician and patient perceptions of IPF that have helped identify unmet informational needs (7–12). However, many medical providers, patients, and caregivers maintain a poor understanding of IPF, its diagnostic criteria, its natural history, and available treatment options (6, 7, 13).

Efforts aimed at identifying the educational needs of providers have largely excluded medical trainees. Thus, the overall comfort level among graduating U.S. pulmonary and critical care medicine (PCCM) fellows with diagnosing and managing ILD is unknown. Furthermore, there are no published data describing the current approach to educating trainees about ILD. The purpose of our study was to better characterize the present state of ILD training during fellowship and to determine perceived abilities in diagnosing and managing ILD among graduating fellows as part of a needs assessment for the Pulmonary Fibrosis Foundation.

METHODS

Study Design and Sample Population

We performed a cross-sectional study of responses from a nationwide survey of

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program directors who lead stand-alone pulmonary or combined PCCM fellowship programs. We also performed a cross-sectional study of survey responses from trainees at 19 preselected PCCM fellowship programs to assess comfort level with ILD in comparison with several other core pulmonary topic areas such as COPD and asthma. Both aspects of this study were reviewed by the University of Pennsylvania Institutional Review Board and deemed exempt from review.

Program Director Survey Methods

The program director survey instrument, which was derived via multiple focus groups consisting of both ILD faculty and PCCM fellowship program leaders at the University of Pennsylvania Perelman School of Medicine and the University of Colorado School of Medicine, was distributed via REDCap software (14, 15) to all program directors who lead Accreditation Council of Graduate Medical Education–accredited stand-alone pulmonary or combined PCCM fellowship training programs. Using a five-point Likert scale, respondents were asked to state their level of agreement with the following three statements, all leading with the same prompt: “Fellows in my program graduate with the ability to...” 1) establish diagnoses for the specific forms or subtypes of ILD; 2) provide initial management of ILD once a specific diagnosis has been determined; and 3) offer longitudinal expert care to patients with ILD. In addition, they were asked several questions about existing ILD-focused training opportunities within their programs and, if made universally available, what supplementary resources would be most beneficial to enhance fellowship training in ILD within their programs.

Trainee Survey Methods

Trainees from 19 preselected Accreditation Council of Graduate Medical Education–accredited PCCM programs were asked to complete a comprehensive survey on ambulatory education as part of a large-scale outpatient curriculum development effort sponsored by the Association of Pulmonary and Critical Care Medicine Program Directors. All attendees at the March 2017 Association of Pulmonary and Critical Care Medicine Program Directors annual meeting were invited to participate. Of the 21 programs that initially expressed interest, 19 were ultimately enrolled (only one stand-alone pulmonary program volunteered and was excluded owing to generalizability concerns, and one PCCM program never obtained internal institutional review board approval). The fellow survey instrument was developed by faculty at the University of Pennsylvania and distributed via Qualtrics software. Fellows were not required to participate. All responses were deidentified. As part of this survey, trainees were asked to provide an assessment of their self-perceived competency in a variety of clinical domains including ILD, COPD, asthma, solitary pulmonary nodules, and several others using a five-point Likert scale.

Statistical Methods

We compared program directors’ perceptions of graduating fellows’ abilities to diagnose, provide initial management to, and offer longitudinal care to patients with ILD using a series of unpaired *t* tests. We then characterized the current state of fellowship ILD training using standard descriptive statistics. Trainee survey responses were averaged, and mean ratings across other clinical domains were compared directly with ILD using a series of

t tests. Statistical significance was defined as $P < 0.05$. All analyses were performed using Stata/IC (StataCorp), version 15.1.

RESULTS

Program Director Survey Results

Responses were received from 74 out of 185 (40.0%) program directors who were invited to complete the nationwide survey. The mean program size was 4.2 fellows per year (standard deviation 1.9 fellows per year). Respondents represented fellowships from a broad geographic distribution (Table 1). A majority of fellowships offered training opportunities at university-based medical centers, whereas less than half offered training opportunities at

community-based hospitals and Veterans Affairs medical centers. In addition, respondents represented institutions from both Care Center Network (CCN) and non-CCN sites. This designation is given by the Pulmonary Fibrosis Foundation to medical centers with expertise in treating adult patients with ILD using a multidisciplinary approach (16). All respondents directed programs with combined pulmonary and critical care medicine training; no responses were received from program directors of stand-alone pulmonary medicine fellowships.

Program directors rated graduating fellows' abilities to establish specific ILD diagnoses and to provide initial management similarly (4.3 ± 0.8 on a

Table 1. Baseline demographics of PCCM fellowships represented by respondents of the nationwide program director survey

Number of respondents (% response rate)	74 (40)
Number of fellows enrolled per year, mean (SD)	4.2 (1.9)
Geographic location, <i>n</i> (%)	
Northeast	27 (36.5)
Southeast	16 (21.6)
Midwest	17 (23.0)
Northwest	3 (4.1)
Southwest	10 (13.5)
Other	1 (1.4)
Training environment(s), <i>n</i> (%)	
University-based hospital	57 (77.0)
Community-based hospital	33 (44.6)
Veterans Affairs medical center	29 (39.2)
CCN site, <i>n</i> (%)	
Yes	32 (43.2)
No	33 (44.6)
Unsure	9 (12.2)

Definition of abbreviations: CCN = Care Center Network; PCCM = pulmonary and critical care medicine.

five-point Likert scale for both). The ability to provide longitudinal expert care was rated significantly lower (3.8 ± 0.9 , $P = 0.001$).

Among program director respondents, 52 (70.3%) reported having dedicated outpatient ILD clinics within their institutions. Although all fellows had the opportunity to rotate within these clinics, only 26 of the 52 (50.0%) program directors required this rotation. In addition, there was marked variability in total number of half-days spent in an ILD clinic over the course of a fellow's training (Figure 1A). Only 17 (23.0%) program directors reported that a majority of initial ILD visits were scheduled in fellows' clinics, whereas 57 (77.0%) reported that initial ILD visits were scheduled in fellows' clinics about half

the time or less (Figure 1B). Furthermore, many patients seen initially by fellows received subsequent longitudinal care from dedicated ILD specialists without continued fellow involvement (Figure 1C).

Despite international guidelines emphasizing the use of multidisciplinary discussions (MDDs) consisting of expert ILD clinicians, radiologists, and pathologists for establishing specific idiopathic interstitial pneumonia diagnoses (17), only 53 (71.6%) program directors reported having regular MDDs at their institutions. In addition, only 35 out of the 53 (66.0%) required that fellows attend one or more MDDs as part of their training.

Table E1 in the data supplement provides a summary of how frequently program

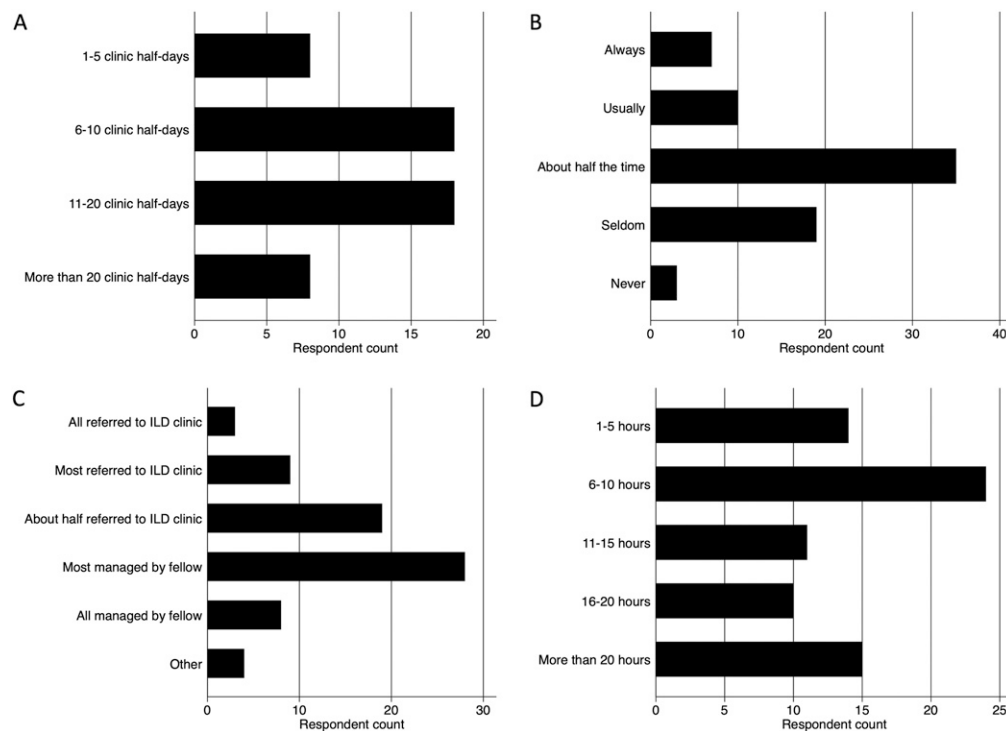


Figure 1. (A) Cumulative number of half-days spent in interstitial lung disease (ILD) clinics throughout fellowship training, as indicated by program director respondents from institutions with dedicated ILD specialists ($n = 52$). (B) Frequency with which initial visits for patients referred with ILD or suspected ILD were scheduled in fellow clinics (as opposed to ILD specialty clinics or other attending practices), as indicated by program director respondents ($n = 74$). (C) Subsequent triaging patterns for patients with ILD initially evaluated in fellow clinics to receive ongoing longitudinal care, as indicated by program director respondents ($n = 74$). (D) Total hours of ILD-focused didactics received by fellows throughout their training, as indicated by program director respondents ($n = 74$).

directors thought fellows used alternative resources not directly relating to patient care to learn about ILD. Notably, nearly half ($n = 36$, 48.6%) of program director respondents reported having ILD-focused lecture-based didactics from internal faculty less than every other month. Furthermore, total number of hours of ILD-specific didactics varied significantly across programs: 1–5 hours, 18.9%; 6–10 hours, 32.4%; 11–15 hours, 14.9%; 16–20 hours, 13.5%; and more than 20 hours, 20.3% (Figure 1D). Although the majority of programs ($n = 42$, 56.8%) provided a recommended ILD reading list to trainees, very few ($n = 12$, 16.2%) offered an ILD-specific journal club as a forum for discussion.

Most program directors felt that clinical settings were superior to nonclinical environments for educating fellows about ILD (Table E2). However, program directors showed low enthusiasm for offering fellows away rotations at CCN-designated sites, if coordinated by the Pulmonary Fibrosis Foundation (Table 2). Rather, there was greater interest in online resources such as ILD-focused didactics and case reviews (i.e., mock MDDs). Nearly half of program directors felt it was likely that at least some of their fellows would take advantage of clinical and research mentorship programs if offered by the Pulmonary Fibrosis Foundation.

Trainee Survey Results

The 19 preselected PCCM fellowships from which fellows were recruited represented a diverse group of programs with varied geographic locations, sizes, and training environments (e.g., university-based, community-based, etc.), both overall and as it specifically relates to primary ambulatory clinic settings. A total of 213 fellows (38.5% first-year, 27.2%

second-year, 33.3% third-year, and 0.9% fourth-year fellows) completed the fellow survey (Table 3). A higher proportion of males responded, and several different career aspirations were reported.

Out of all clinical domains assessed, fellows were uniformly the least comfortable with ILD. In addition, there were marked discrepancies in how trainees rated their own ability levels relative to how program directors perceived trainees' ability levels. Among 71 third-year fellows, more than half ($n = 40$, 56.3%) reported a comfort level of "neutral" or less with managing patients with ILD (mean 3.2 ± 1.0 on a five-point Likert scale, Table 4). A significantly smaller proportion of third-year fellows reported a neutral or less comfort level with more common pulmonary diseases like COPD ($n = 2$, 2.8%; mean 4.4 ± 0.7 , $P < 0.001$) and asthma ($n = 8$, 11.3%; mean 4.2 ± 0.8 , $P < 0.001$). A complete summary of self-assessed competency data for third-year fellows across various clinical domains within pulmonary medicine is shown in Table 4.

DISCUSSION

ILD is associated with significant morbidity and mortality, underscoring the importance of establishing timely and accurate diagnoses so that patients can be initiated on appropriate therapies. Physician discomfort leading to delays in diagnosing and treating ILD poses a substantial risk to patients (6, 7). In our study, graduating fellows were least comfortable with ILD out of all clinical domains assessed and rated their confidence level in managing ILD significantly lower in comparison with more common pulmonary diseases such as COPD and asthma. In addition, they generally perceived their overall clinical abilities in ILD more poorly than how they were perceived by program directors.

Table 2. Likelihood of program director use of supplementary ILD educational resources if made universally available to fellowship programs

Educational Resource	Degree of Likelihood [n (%)]		
	Unlikely	Neutral	Likely
Online ILD-focused didactics	9 (12.2)	12 (16.2)	53 (71.6)
Annotated ILD reading list	4 (5.4)	7 (9.5)	63 (85.1)
Online case review (i.e., mock MDDs)	7 (9.5)	9 (12.2)	58 (78.4)
Online journal clubs	17 (23.0)	25 (33.8)	32 (43.2)
Away rotations at PFF care center network sites	40 (54.1)	11 (14.9)	23 (31.1)
PFF clinical mentorship programs	23 (31.1)	15 (20.3)	36 (48.6)
PFF research mentorship programs	26 (35.1)	12 (16.2)	36 (48.6)

Definition of abbreviations: ILD = interstitial lung disease; MDDs = multidisciplinary discussions; PFF = Pulmonary Fibrosis Foundation. Number of respondents = 74.

This disconnect may explain in part why we observed such marked variability in ILD training across U.S. PCCM fellowship programs nationwide

Furthermore, we noted significantly lower ratings by program directors of graduating fellows' abilities to offer longitudinal expert care to patients with ILD relative to their abilities to diagnose and provide initial management to patients with ILD. These differences could potentially be explained by the outpatient triaging patterns that we observed in our study. Program directors reported that a minority of initial ILD consultations were scheduled in fellows' clinics. In addition, many patients seen in fellows' clinics were subsequently managed by ILD specialists, thus minimizing opportunities for fellows to engage in longitudinal patient care.

Our findings suggest that additional resources such as a shared ILD curriculum and formalized mentorship programs are needed to augment the experiences of trainees. In our study, clinical environments were generally regarded as more effective in educating fellows about ILD (as

opposed to didactics, journal clubs, etc.). However, when asked what resources program directors would be most likely to use if made universally available, there was a strong preference for easily accessible online materials and generally low enthusiasm for away rotations at CCN-designated sites. Thus, efforts geared toward the development of a shared ILD curriculum should emphasize online case review with clinical information and relevant radiology and pathology (i.e., mock MDDs). In addition, individual training programs should be encouraged to review the referral patterns of patients with ILD to ensure that fellows are receiving adequate outpatient ILD exposure, whether in their own clinics or within ILD specialty clinics. Lastly, fellowship directors expressed strong enthusiasm for both clinical and research fellow mentorship programs in ILD, highlighting the importance of creating early career networking opportunities, particularly for those trainees at non-CCN sites.

Our study has several limitations. Although program director respondents

Table 3. Baseline demographics of study participants who completed the fellow survey

Demographics	n (%)
Training year	
First	82 (38.5)
Second	58 (27.2)
Third	71 (33.3)
Fourth	2 (0.9)
Sex	
M	139 (65.3)
F	71 (33.3)
Prefer not to say	3 (1.4)
Training environment(s)	
Large tertiary care academic medical center	195 (88.2)
Academic-affiliated community-based hospital	66 (29.9)
Veterans Affairs medical center	113 (51.1)
County hospital	47 (21.3)
Community practice	7 (3.2)
Private practice	3 (1.4)
Other	1 (0.5)
Primary ambulatory clinic setting	
Large tertiary care academic medical center	136 (63.8)
Academic-affiliated community-based hospital	30 (14.1)
Veterans Affairs medical center	35 (16.4)
County hospital	0 (0.0)
Community practice	4 (1.9)
Private practice	0 (0.0)
Other	8 (3.8)
Current career aspiration	
Clinical focus	46 (21.6)
Clinician educator/medical education	38 (17.8)
Research, clinical	17 (8.0)
Research, basic science	8 (3.8)

(continued on following page)

Table 3. Baseline demographics of study participants who completed the fellow survey (continued)

Demographics	n (%)
Advanced clinical training (e.g., interventional pulmonology)	19 (8.9)
Some combination of the above	73 (34.3)
Unsure	12 (5.6)

Number of respondents = 213.

represented a geographically diverse pool of fellowship programs offering training opportunities in multiple clinical settings, our response rate was only 40%. Any unmeasurable differences between respondents and nonrespondents may have had the potential to introduce selection bias. In addition, we only received responses from program directors of combined PCCM fellowships; thus, our findings may not be generalizable to stand-alone pulmonary training programs. An initial goal of our study was to identify particular program attributes that were associated with higher perceived fellow abilities to diagnose and

manage ILD. However, program directors generally rated these abilities very highly (typically four or more on a five-point Likert scale). This lack of normality in the response data prohibited us from using linear or logistic regression methods to study associations between specific program attributes and perceived abilities in diagnosing and managing ILD.

Conclusion

Our findings highlight the significant variability in exposure to ILD across PCCM fellowships nationwide. Future efforts aimed at developing a standardized ILD

Table 4. Self-assessed comfort among third-year fellows with managing various pulmonary diseases

Clinical Domain	Confidence Level [n (%)]					Mean (SD)	P Value*
	Very Unconfident 1	Unconfident 2	Neutral 3	Confident 4	Very Confident 5		
ILD	2 (2.8)	19 (26.8)	19 (26.8)	25 (35.2)	6 (8.5)	3.2 (1.0)	Ref.
IPF	1 (1.4)	12 (16.9)	21 (29.6)	30 (42.3)	7 (9.9)	3.4 (0.9)	0.17
COPD	1 (1.4)	0 (0.0)	1 (1.4)	37 (52.1)	32 (45.1)	4.4 (0.7)	<0.001
Asthma	1 (1.4)	2 (2.8)	5 (7.0)	39 (54.9)	24 (33.8)	4.2 (0.8)	<0.001
Solitary pulmonary nodule	1 (1.4)	1 (1.4)	11 (15.5)	37 (52.1)	21 (29.6)	4.1 (0.8)	<0.001
Community-acquired pneumonia	1 (1.4)	1 (1.4)	4 (5.6)	37 (52.1)	28 (39.4)	4.3 (0.8)	<0.001
Pleural effusion	0 (0.0)	1 (1.4)	5 (7.0)	46 (64.8)	19 (26.8)	4.2 (0.6)	<0.001
Venous thromboembolism	1 (1.4)	1 (1.4)	7 (9.9)	40 (56.3)	22 (31.0)	4.1 (0.8)	<0.001

Definition of abbreviations: COPD = chronic obstructive pulmonary disease; ILD = interstitial lung disease; IPF = idiopathic pulmonary fibrosis; Ref. = reference; SD = standard deviation.

Number of respondents = 71.

*P values are for comparisons of means for ILD versus other clinical domains using unpaired *t* tests.

curriculum should focus on providing fellows with a breadth of online cases and didactics, as well as access to clinical and research mentorship programs in ILD.

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