Diagnostic accuracy of a clinical diagnosis of idiopathic pulmonary fibrosis: an international case-cohort study.

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ABSTRACT

BACKGROUND

With the advent of anti-fibrotic therapies, the distinction between IPF and other ILDs has become central to accurate management. We conducted an international study of IPF diagnosis among a large group of physicians with different levels of experience and compared their diagnostic performance to a panel of IPF experts. Candidate factors impacting diagnostic accuracy were evaluated.

METHODS

3423 respiratory physicians from 102 countries and a panel of international IPF experts (n=34) were invited to participate. Participants were required to evaluate 60 consecutive cases of interstitial lung disease. Each physician, without inter-disciplinary consultation, selected up to five differential diagnoses and chose likelihoods for each of their differential diagnoses. Diagnostic agreement was measured using Cohen's kappa coefficient (κ) and the weighted kappa coefficient (κw). Prognostic discrimination between IPF and other diffuse lung diseases were used to validate diagnostic accuracy for first-choice diagnoses of IPF and were compared using the C-index·

FINDINGS

404 physicians completed the study. IPF made up 6308 (26·0%) of all first-choice diagnoses. Agreement for the diagnostic likelihood of an IPF diagnosis was highest among expert physicians (κw =0·65 [IQR 0·53-0·72]), and greater than among academic physicians (κw =0.56 [IQR 0.45-0.65], p<0.0001) or among physicians with access to multidisciplinary team (MDT) meetings (κw =0.54 [IQR 0.45-0.64], P<0.0001).

Academic status, greater than 20 years experience and MDT meeting attendance were independently associated with prognostic accuracy of a diagnosis of IPF. The prognostic accuracy of academic physicians with greater than 20 years experience (C-index=0·72, [IQR 0·0-0·73])) did not differ significantly (p=0·229) from the prognostic accuracy of diagnoses of IPF made by the expert panel (C-index=0·74 [IQR 0·72-0·75]). Prognostic accuracy of non-university hospital physicians with more than 20 years experience, attending weekly MDT meetings (C-index=0·72, [IQR 0·70-0·72]) approached expert-level performance (p=0·052).

INTERPRETATION

Academic status, attendance at MDT meetings and greater than 20 years experience independently predict the prognostic accuracy of IPF diagnosis among a large cohort of respiratory physicians drawn from many countries. Experienced respiratory physicians working at university-based institutions make diagnoses of IPF with similar prognostic accuracy to an international panel of IPF experts.

FUNDING

INTRODUCTION

Idiopathic pulmonary fibrosis (IPF) is characterised by progressive loss of lung function and a particularly poor prognosis [1]. Although it is often regarded as a rare disorder, in 2012 1% of all deaths in the United Kingdom occurred due to IPF [2] and the incidence of IPF is expected to continue to rise [3-8]. Accurate IPF diagnosis has increased in importance with the advent of anti-fibrotic therapies and on-going enrolment in IPF treatment trials [9,10].

Although the ATS/ERS/JRS/ALAT guideline diagnostic recommendations emphasise the importance of a multidisciplinary (MD) approach when diagnosing IPF [11-13], less experienced non-academic clinicians outside regional centres may not have access to multidisciplinary team meetings[14]. Therefore, the diagnostic accuracy of clinicians acting in isolation is of practical importance. In the absence of a reference standard, one approach to evaluating the diagnostic skills of clinicians is to examine separations in mortality between patients diagnosed with IPF and those diagnosed with other ILDs, a method used in a recent study of MD diagnosis [15]. The most accurate discrimination between IPF and non-IPF diagnoses should, in principle, provide the greatest separation in outcomes.

The aim of this study was to evaluate and compare IPF diagnoses made by non-academic clinicians, university-affiliated clinicians and an international panel of IPF experts, using three surrogates of diagnostic accuracy: diagnostic confidence, diagnostic agreement and prognostic accuracy (which was examined in non-expert sub-groups against years of experience and access to an MDT meeting).

METHODS

Case collection

The study protocol was approved by the NHS Health Research Authority, and for this retrospective examination of clinically indicated data, the need for patient consent was waived. We selected consecutive patients presenting to the interstitial lung disease unit of the Royal Brompton and Harefield NHS Foundation Trust (London, United Kingdom) between January 5th, 2010 and October 25th, 2010 (see Supplementary Appendix, Figure 1). This approach allowed an analysis of 5-year survival and also meant that patients included in the study were selected from a pre-antifibrotic therapy era. Therefore, outcome distinctions between patients with IPF and those without this disease were not confounded by antifibrotic therapy. Since referral rates of patients with suspected IPF to the host institution in 2010 differed (25% of all referrals) from 2015 (36% of all referrals), we enriched the cohort with consecutive patients referred to the host institution between January 5th, 2010 and October 25th, 2010 and who were diagnosed with IPF by the host institution, to match 2015 IPF referral rates. Exclusion criteria were:

- An established diagnosis of connective tissue disease prior to presentation to the host institution. In these patients, the diagnosis of connective tissue disease-related ILD is usually straightforward and might spuriously increase overall diagnostic agreement [15].

- Non-availability of imaging or lung function tests at presentation.

- DLco<30% predicted, excluded because: a) clinicians might assume that the presence of end-stage fibrosis indicates IPF thus impacting diagnostic

agreement and accuracy for an IPF diagnosis; b) although patients with end-stage fibrotic lung disease may occasionally be referred to the host institution, this may not reflect referral patterns to less specialised centres; c) treatment may be less effective in patients with end-stage fibrosis reducing the importance of diagnostic precision.

Participating physicians

Between January 1st, 2015 and July 1st, 2016 we performed an Internet search, country by country, for practising respiratory physicians. Physician experience, nationality, academic status (working at a university hospital or not a university hospital) or subspecialist interests within respiratory medicine did not influence inclusion eligibility. This search included the European Respiratory Society Diffuse Parenchymal Lung Disease Assembly and the American Thoracic Society Clinical Problems Assembly. During July 2016 an invitation to participate in the study was extended to all of the physicians identified. In addition to this group, an expert panel was created, comprising of respiratory physicians with specialist expertise in the diagnosis and management of interstitial lung disease working in specialist ILD centres and with a track record of publications in this field.

Scoring Protocol

Evaluation of cases took place between July 1st, 2016 and January 1st, 2017 on a custom built web-based application. First, physicians were required to answer a preliminary survey regarding their usual clinical practice (Supplementary Appendix, Table A1). Then for each case they were presented with the patient's history, findings on physical examination and standardised baseline clinical information,

extracted from the patient electronic records (Supplementary Appendix, Table A2). Physicians were provided the presentation high-resolution computed tomography scan (HRCT). The original HRCT report was not provided. We did not inform physicians if the host institution had performed surgical lung biopsy. Since biopsy decisions depend on a physician's individual clinical judgement, there would be no way of knowing which patients would eventually have undergone a lung biopsy. Also, if we had provided biopsy information, the clinical skill of the physician would be amalgamated with the expertise of the host institution.

The scoring protocol has been described previously [15]. For each case, physicians were required to select up to 5 differential diagnoses and provide a diagnostic likelihood (censored at 5% and summing to 100% in each case) from a drop-down menu of diffuse lung diseases (Supplementary Appendix, Table A3). The drop-down menu included a category labelled 'other', to be selected when the desired diagnosis was not listed. In this situation, physicians were required to provide their diagnosis in a free-text box. The only stipulation to scoring the cases was that each case was evaluated in isolation without inter-specialty consultation.

Statistical analysis

Statistical analyses were performed using STATA (version 14, StataCorp, College Station, Texas). Data are given as means with standard deviations (SD), medians with interquartile range (IQR) or as the number of patients and percentage where appropriate. Group comparisons were made using the Student's t-test, Wilcoxon rank sum, X^2 statistics and Fisher's exact test where appropriate.

Cohen's kappa coefficient (κ) was used to evaluate interobserver agreement for diagnosis and Cohen's weighted kappa coefficient (κw) was used to evaluate

interobserver agreement for an estimation of the probability of each diagnosis. In order to do this, the percentage diagnostic likelihood given for each diagnosis was converted to a 5 point scale (0–4), representing clinically useful probabilities: 0 = condition not included in the differential diagnosis, 1 = low probability (5–25%), 2 = intermediate probability (30–65%), 3 = high probability (70–95%), and 4 = pathognomonic (100%). This approach has been used in previous investigations of interobserver agreement for the diagnosis of diffuse lung diseases [15-17] (Supplementary Appendix, Methods). Additionally, for each patient the first-choice diagnosis was considered high confidence if the diagnostic likelihood assigned was ≥70%. This distinction is based on the diagnostic likelihood categories used to assess the clinical probability of pulmonary embolism in the PIOPED study[18] and has been used in another study of diagnostic agreement [15].

We used outcome distinctions between IPF and other diffuse lung diseases to validate diagnostic accuracy for IPF by converting each physician's first-choice diagnosis into a binary IPF diagnosis category (IPF or not IPF) and determining its prognostic significance using Cox proportional hazards modelling. The hazards ratios were adjusted for disease severity by including percent predicted DLco in the regression model. Results are reported as HRs, 95% CIs, and p values. A p value of <0·05 was considered statistically significant. The prognostic accuracy of individual physician diagnoses was quantified using Harrell's C-index, which when used in this context, is a measure of prognostic discrimination (Supplementary Appendix, Methods)[19]. Multivariate linear regression models were used to identify independent predictors of prognostic accuracy, using a backward elimination procedure and retaining variables with p values <0·05. The assumptions of linear regression were tested and confirmed by inspection of residual-versus-predictor plots and

heteroskedasticity was tested for graphically (by inspection of residuals plotted against fitted values) and non-graphically (using the Cook-Weisberg test for heteroskedasticity). The diagnostic performance of various subgroups of physicians based on these predictors was then compared to the expert panel group.

RESULTS

Patient population and participating physicians

The total cohort of cases was made up of 60 patients, including 22 (36·7%) with an MDT meeting diagnosis of IPF. Five patients required surgical lung biopsy. Three of these were diagnosed as IPF, one as pulmonary alveolar proteinosis and one as obliterative bronchiolitis. Vital status was known for all patients at the end of the study period. There were 26/60 (43·4%) deaths at the end of the study period. Mean follow-up period for IPF and non-IPF cases were 1246.0 days and 1646.0 days respectively. For more details of patient exclusions, diagnoses and mortality, see the Supplementary Appendix (Results Section and Table A4).

A total of 3423 respiratory physicians from 102 countries were invited to participate in the study. Between July 7th, 2016 and January 1st, 2017, 750 physicians representing 76 countries enrolled and completed the preliminary survey. Of these, 404 physicians, representing 57 countries, which included a panel of 34 invited experts, completed the evaluation of all 60 cases. Physicians who completed the study were more likely to be fellowship trained, work at university hospitals, have access to MDT meetings, and diagnose more cases of IPF per month (Table 1 and Table 2). A summary of physician demographics based on country is shown in the supplementary material (Table A5).

Frequency of IPF diagnosis and diagnostic confidence

A total of 24240 case evaluations were performed (404 physicians x 60 cases). IPF made up 6308 (26·0%) of all first-choice diagnoses. 72·3% of IPF diagnoses were made with high confidence (diagnostic likelihood ≥ 70%). Expert panel members and academic physicians made high confidence diagnoses of IPF more frequently than non-academic physicians (P=0·002 and P=0·001, Table 3) and more frequently diagnosed IPF overall (P=0·005 and P=0·008, Table 3). Attendance at MDT meetings was not associated with a higher frequency of IPF diagnoses or a higher frequency of highly confident IPF diagnoses (P=0·718, P=0·925, Table 3).

Diagnostic agreement

Overall interobserver agreement for the first-choice diagnosis of IPF was moderate for the entire cohort of physicians (n=404, K=0·42). Unweighted Kappa values for interobserver agreement for a diagnosis of IPF for various physician subgroups are shown in Table 4. The greatest diagnostic agreement for the first-choice diagnosis of IPF was between the expert panel members (n=34, K=0·53). Physicians with no access to MDT meetings had the lowest level of diagnostic agreement for the first-choice diagnosis of IPF (n=76, K=0·35) (Table 4). Agreement on the likelihood of an IPF diagnosis (ranging from <5% to >95%) was highest among expert physicians, academic physicians and physicians with access to MDT meetings (Table 5). Inter-observer agreement for the likelihood of an IPF diagnosis between physicians based on country is shown in the supplementary material (Table A6).

Prognostic accuracy of an IPF diagnosis

Diagnoses of IPF were prognostically significant for 318 of 404 respiratory physicians (68·6%, median HR=2·81 [IQR 2·21-3·61], median C-index=0·72 [IQR 0·70-0·74]). Hazards ratios, p values and C-indices for all participating physicians based on country are shown in the supplementary material (Supplementary Appendix, Table A7). Expert physicians, compared to other physicians, were more likely to make prognostically significant IPF diagnoses (29/34, 85·2%, versus 246/370, 66·4%, p=0·02) and with greater prognostic discrimination (as judged by C-indices), p=0·0002 (Supplementary Appendix, Table A8). Academic physicians demonstrated greater prognostic discrimination for a diagnosis of IPF than non-university based hospital physicians, p=0·0006 (Table A9). Physicians who attend MDT meetings demonstrated greater prognostic discrimination for a diagnosis of IPF than physicians not attending MDT meetings, p=0·004, Table A10).

Multivariate linear regression analysis was performed taking the C-index as the dependent variable and 1) academic status, 2) years experience (stratified by thresholds ranging from 5-35 years in 5 year increments), 3) MDT meeting attendance and 4) number of IPF cases diagnosed per month as the independent variables. Academic status, >20 years experience and attendance at MDT meetings independently predicted the prognostic accuracy of IPF diagnosis (Supplementary appendix, A11). Subsequent analyses of particular interest are summarised in Table 6. Specifically,

1. University hospital physicians with >20 years of experience achieved equivalent prognostic discrimination to the expert panel for a diagnosis of IPF (or not IPF group), regardless of attendance at weekly MDT meetings (Table 6).

2. Non-university hospital physician prognostic discrimination did not reach that of the expert panel, regardless of availability of MDT meetings or the threshold of 20 years of experience (Table 6). However, non-university hospital physicians with >20 years of experience, attending *weekly* MDT meetings, demonstrated near expert level prognostic accuracy (C-index 0·72 (IQR 0·70-0·72), p=0·052).

DISCUSSION

Our results show that academic status, attendance at MDT meetings and experience level of physicians are independently associated with greater prognostic discrimination between diagnoses of IPF and other ILDs. In particular, using mortality to validate accuracy of IPF diagnosis, we have shown that accuracy of IPF diagnosis made by university hospital-based practitioners with greater than 20 years experience is equivalent to that of international IPF experts.

A recent study reported near parity in diagnostic agreement and accuracy for IPF between expert physicians and their respective MDT meetings [15]. The purpose of this study was to investigate whether these findings could also be applied to physicians of varying levels of experience when acting in isolation without the benefit of MDT meeting evaluation. A central feature of our study was that we validated IPF diagnosis against mortality, an approach used in a previous study of diagnostic agreement and accuracy in IPF [15]. In diffuse lung disease, multidisciplinary discussion is the recommended approach to diagnosis, which involves integrating all available clinical, radiologic and if available, pathologic data. For this reason, there is no reference standard against which the veracity of MDT diagnosis can be tested.

However, as a poor outcome is a cardinal feature of IPF, accurate diagnosis should, in principle, provide the greatest prognostic discrimination between IPF and other interstitial lung diseases.

Although several studies have reported that MDT diagnosis is associated with higher levels of diagnostic confidence and superior interobserver agreement when compared to the individual components of the MDT in isolation [15,20,21], the effect that MDT meetings have on individuals has not been examined. One of the assumed benefits of a multidisciplinary approach to IPF diagnosis is that those participating have their diagnostic thinking subjected to public scrutiny. The regular inter-specialty discussion that MDT meetings promote is likely to broaden a physician's experience and establish an ethos of debate and critical evaluation. Conceivably, physicians who are accustomed to this process gain skill in related disciplines such as HRCT interpretation, which they can use outside the multidisciplinary setting. For some physicians, increasing patient numbers and possibly referrals from other centres will mean that full MDT meeting characterization is possible only for selected cases. Therefore, just as in this study, it is likely that a substantial number of IPF patients will receive a diagnosis made by their respiratory physician acting in isolation. In a recent national survey conducted in France, IPF diagnosis resulted from multidisciplinary discussion in only 50% of cases[22]. It is noteworthy that in the current study, 43% of completing physicians stated that in most cases of suspected IPF, they made the diagnosis by themselves with the aid of diagnostic guidelines. We demonstrate that weekly MDT meeting attendance among experienced non-university hospital physicians increased prognostic accuracy of IPF diagnosis to that achieved by IPF experts.

Our findings may have implications for future multidisciplinary practice. Based on several studies of diagnostic agreement and accuracy over the past decade, MDT evaluation of IPF has become enshrined in the literature as the optimum approach to diagnostic synthesis [1,12,13,15,20,23,24]. A difficulty implementing this recommendation is that local access to multidisciplinary expertise may be limited. One possible solution to this problem is to network with academic centres using different forms of telemedicine. Since the web-based evaluation of patients in this study to some extent replicates telemedicine methodologies, our findings provide support for telemedicine as an acceptable form of multidisciplinary practice [24,25]. Such collaboration could also include guidance on setting up local community hospital MDT meetings or having community physicians attend MDT meetings at local university hospitals.

Our study has some unavoidable limitations, common to previous studies of multidisciplinary practice [15-17]. First, unlike real-world clinical practice, it was impractical for physicians to engage in face-to-face consultation with patients, meaning that doctors did not have the chance to take a clinical history or examine the patients themselves. In complex disease, direct contact with the patient may influence a clinician's impression in a manner that is not easy to quantify objectively. However, direct patient contact in a study of this size would have been impracticable. Our methodology of web-based case reviews is instead similar to that of previously published studies of diagnostic agreement and accuracy between MDT meetings [15,20,26]. Second, physicians who completed the study were more likely to be fellowship trained, work at university institutions, attend MDT meetings and diagnose more cases of IPF per month. Nevertheless, sufficient numbers of physicians working in non-university institutions and without access to MDT meetings took part

in our study, allowing us to perform statistically meaningful analyses in these subgroups. Third, to our knowledge no guideline recommendation indicates what precisely constitutes a valid MDT meeting. Although we asked physicians if they participated in formal MDT meetings, we did not attempt to quantify informal inter-specialty consultation, which might also be considered by some to be a form of multidisciplinary practice[27]. An investigation to identify the optimum MDT meeting format could be the focus of future investigation.

In conclusion, our study indicates that diagnostic agreement for IPF is acceptable between a large group of respiratory physicians of varying degrees of experience and drawn from a wide range of geographic locations. However, experienced respiratory doctors who work at university-based institutions show greater agreement on a diagnosis of IPF and make greater prognostic distinctions between IPF and other diffuse lung diseases than those at non-university institutions. Importantly, the diagnostic performance of experienced non-university practitioners improves with regular MDT meetings. These results may be a stimulus for greater interaction between university and community hospitals as well as the development of local MDT meetings for the specific purpose of assessing patients with suspected IPF.

Research in context

Evidence before this study

We performed a PubMed search on 1th January 2017 using the search terms "diffuse parenchymal lung disease", "idiopathic pulmonary fibrosis", "idiopathic interstitial pneumonias", "interobserver agreement", "diagnosis", "usual interstitial pneumonia", "pulmonary fibrosis", "multidisciplinary team" and "diagnostic accuracy" for the period

between January 2000 and January 2017. Our search was restricted to publications written in English. We identified 12 key publications, which were pertinent to our study. Of these, 4 studies of diagnostic performance in setting of idiopathic pulmonary fibrosis (IPF) were identified. All of these 4 studies either predate the current ATS/ERS/JRS/ALAT guideline statement on the diagnosis and management of IPF or specifically evaluated multidisciplinary team meeting diagnosis of IPF.

Added value of this study

Our study is the first evaluation of diagnostic confidence, diagnostic agreement and prognostic accuracy for a clinical diagnosis of IPF among a large international group of respiratory physicians since the updated 2013 ATS/ERS classification of the idiopathic interstitial pneumonias and the 2011 ATS/ERS/JRS/ALAT guidelines for the diagnosis and management of IPF. Candidate factors, which impact diagnostic performance, including academic status, experience and in particular, attendance at multidisciplinary meetings were evaluated.

Implications of all the available evidence

Our study indicates that diagnostic agreement for IPF is acceptable between a large group of respiratory physicians of varying degrees of experience and drawn from a wide range of geographic locations. Experienced respiratory physicians who work at university-based institutions show greater agreement on a diagnosis of IPF and make sharper prognostic distinctions between IPF and other diffuse lung diseases than those at non-university institutions. The diagnostic performance of experienced non-university practitioners improves if access to regular MDT meetings is available. Our results may be a stimulus for increased collaboration between university and

community hospitals and encourage the development of local MDT meetings for the specific purpose of assessing patients with suspected IPF.

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Question	Completed (n=404)	Did Not Complete (n=346)	P Value
Years experience	15·8	15·7	0·565
ILD Fellowship training			
Yes	359 (88·9%)	283 (70·0%)	0·006
In-training	17 (4·2%)	20 (5·8%)	0·322
No	28 (6·9%)	43 (12·4%)	
Hospital setting			
University	288 (71·3%)	207 (59·8%)	0·001
Not university	116 (28·7%)	139 (40·2%)	
MDT meeting			
MDT meeting access	328 (81·2%)	247 (61·8%)	0·002
No MDT meeting access	76 (18·8%)	99 (28·6%)	
Number of cases of IPF diagnosed/month			
None, we refer all cases of suspected IPF to an academic centre	20 (5·0%)	38 (11·0%)	0·002
1-10	337 (83·4%)	290 (83·8%)	0·883
11-20	37 (9·2%)	12 (3·5%)	0·002
20+	9 (2·2%)	5 (4·1%)	0·430
Access to specialist radiology expertise			
None	22 (5·4%)	26 (7·5%)	0·191
Not directly but in my network	60 (14·9%)	58 (16·8%)	0·474
Yes	322 (79·7%)	262 (75·7%)	0·248
Access to specialist pathology expertise			
None	34 (8·4%)	35 (10·1%)	0·006
Not directly but in my network	85 (21·0%)	100 (28·9%)	0·013
Yes	285 (70·5%)	211 (61·0%)	0·422
Availability of cryobiopsy			
Yes	65 (16·1%)	44 (12·7%)	0·191
No	339 (83·9%)	302 (87·3%)	

Table 1. Responses to the preliminary survey by 404 physicians who completed the study and the 346 physicians who did not completed the study. ILD= interstitial lung disease.

Grouping	University Hospital (n=288)	Not University Hospital (n=116)	P Value
Experience (years)	14·9	17·8	0·009
Fellowship trained	251	108	0·085
MDT meeting practices			
No MDT meeting	41	35	0·001
Daily MDT meeting	4	0	0·202
Weekly MDT meeting	118	25	0·001
Fortnightly MDT meeting	41	8	0·021
Monthly MDT meeting	66	34	0·178
Less than 1/month MDT meeting	18	14	0·05
Number of IPF cases diagnosed/month			
Refer all cases of suspected IPF	14	6	0·896
1-10 cases	234	103	0·065
11-20 cases	32	5	0·032
More than 20 cases	7	2	0·663
Access to radiology expertise			
Direct access	242	80	0·001
Access through network	35	25	0·016
No access	11	11	0·023
Access to pathology expertise			
Direct access	219	66	0·001
Access through network	49	36	0·002
No access	20	14	0·093
Cryobiopsy part of usual practice	54	11	0·022

Table 2. Responses to the preliminary survey by 404 physicians grouped according to institution type (University hospital or not university hospital). MDT = multidisciplinary team, IPF = idiopathic pulmonary fibrosis.

	Expert Panel physicians (n=34)	Others (n=370)	P Value
Median number of IPF diagnoses	20 (IQR14-23)	15 (IQR 11-19)	0·005
*Median number of high confidence IPF diagnoses	17 (IQR8-21)	11 (IQR 7-14)	0·002
	University Hospital Physicians (n=288)	**Not University Hospital Physicians (n=116)**	**P Value**
Median number of IPF diagnoses	16 (IQR12-20)	13 (IQR10-19)	0·008
*Median number of high confidence IPF diagnoses	11 (IQR 8-16)	9 (IQR 6-12)	0·001
	MDT Meeting Attendance (n=328)	**No MDT Meeting Attendance (n=76)**	**P Value**
Median number of IPF diagnoses	15 (IQR11-20)	15 (IQR10-20)	0·925
*Median number of high confidence IPF diagnoses	11 (IQR 7-15)	11 (IQR 6·5-15)	0·718

Table 3. Median number of IPF diagnoses made and median number of high confidence IPF diagnoses made for individual physicians by subgroup. All values are out of 60 cases. *High confidence diagnoses are defined as those cases assigned a diagnosis of IPF with a diagnostic likelihood of $\geq$70%.

Group	Interobserver Agreement (κ)
Physicians, expert panel (n=34)	0·53
Physicians, non expert panel (n=370)	0·41
University physicians (n=288)	0·43
Non-university physicians (n=116)	0·38
Physicians with MDT meeting access (n=328)	0·44
Physicians without MDT meeting access (n=76)	0·35

Table 4. Unweighted Kappa values (κ) for interobserver agreement for a diagnosis of idiopathic pulmonary fibrosis for various physician subgroups.

Group Comparisons	Interobserver Agreement (κw)	P value
Physicians, expert panel (n=34)	0·65 (IQR 0·53-0·72)	<0·001
Remaining Physician group (n=370)	0·53 (IQR 0·41-0·63)	
University hospital physicians (n=288)	0·56 (IQR 0·45-0·65)	<0·001
Non-university hospital physicians (n=116)	0·49 (IQR 0·38-0·59)	
MDT meeting available (n=328)	0·54 (IQR 0·45-0·64)	<0·001
No MDT meeting available (n=76)	0·48 (IQR 0·35-0·59)	

Table 5. Comparisons of weighted Kappa values (κw) for interobserver agreement on the diagnostic likelihood of a diagnosis of idiopathic pulmonary fibrosis between various subgroups.

University hospital physicians			Non-university hospital physicians		
Group	**C-index**	**P Value***	**Group**	**C-index**	**P Value***
>20 years experience, no MDT meeting (n=11)	0·72 (0·70-0·73)	0·229	>20 years experience, no MDT meeting (n=18)	0·70 (0·70-0·73)	0·008
>20 years experience, MDT meeting (n=51)	0·72 (0·71-0·75)	0·116	>20 years experience, MDT meeting (n=24)	0·71 (0·70-0·73)	0·019
<20 years experience, no MDT meeting (n=30)	0·71 (0·70-0·72)	<0·001	<20 years experience, no MDT meeting (n=17)	0·70 (0·70-0·71)	<0·001
<20 years experience, MDT meeting (n=167)	0·72 (0·70-0·74)	0·001	<20 years experience, MDT meeting (n=52)	0·71 (0·69-0·72)	<0·001

Table 6. Prognostic accuracy expressed as the C-index for diagnosis of IPF or not IPF given by various physician subgroups. P values are based upon a group comparison with the expert panel (n=34, C-index = 0·74 (0·72-0·75)). MDT= multidisciplinary team.

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