Does training respiratory physicians in clinical respiratory physiology and interpretation of pulmonary function tests improve core knowledge?

Abstract Lung function tests have a major role in respiratory medicine. Training in lung function tests is variable within the European Union. In this study, we have shown that an internship in a lung function tests laboratory significantly improved the technical and diagnostic skills of French respiratory trainees.

INTRODUCTION

Lung function tests (LFT) are a central component for the diagnosis, evaluation and the follow-up of respiratory diseases. Respiratory physicians are responsible for the analysis of LFT. Such analysis requires core knowledge on respiratory physiology and physiopathology.[1] Technical and practical aspects of LFT must also be understood.[2] Unlike bronchoscopy,[3–5] there are no clear guidelines on the number of LFT that respiratory trainees have to perform and/or interpret during their training.

Across Europe, training on LFT is highly variable. If dedicated lectures are widely provided, technical and practical training are inconsistent. In the UK and Switzerland, respiratory residents do not attend any dedicated placement in a LFT laboratory. In Spain, Portugal and Czech Republic, such placements are mandatory. In other countries such as Greece and Italy, this practical training is optional. In France, an internship in a LFT laboratory is recommended to all respiratory residents but is not accessible to a majority of respiratory trainees.

Given these disparities across Europe and in France, we decided to evaluate the usefulness of such an internship. The aim of this study was to compare the technical skills and the accuracy of LFT interpretation of respiratory trainees that had an internship in a LFT laboratory with those who did not.

METHODS

We conducted a nationwide cross-sectional study on French respiratory residents. The study consisted of a questionnaire given to French respiratory residents during teaching seminars organised between March and May 2014. Those teaching sessions were held in seven different academic districts across the country. Attendance to these teaching seminars is mandatory for respiratory residents during their 4-year training (see online supplement 1 for further details on French respiratory training).

The questionnaire was conceived by senior respiratory physicians working in a LFT laboratory and affiliated to the French Respiratory Society (Société de Pneumologie de Langue Française). The questionnaire was designed to evaluate (1) technical aspects of LFT and (2) accuracy of LFT interpretation. The questionnaire included multiple choice questions and open short answer questions. It was divided in three parts: assessment of technical knowledge, interpretation of basic LFT (diagnosis of obstruction, hyperinflation and restriction, arterial blood gas analysis) and interpretation of advanced LFT (diagnosis of upper airway obstruction, shunt and respiratory muscle weakness). The maximum score for the questionnaire was 38 (12 points for technical aspects, 14 for basic LFT and 12 for advanced LFT). Each correct answer was awarded 1 point.

In 2014, during the second teaching seminar of each academic district, the National Respiratory Teachers College (Collège des Enseignants de Pneumologie) asked attending respiratory residents to

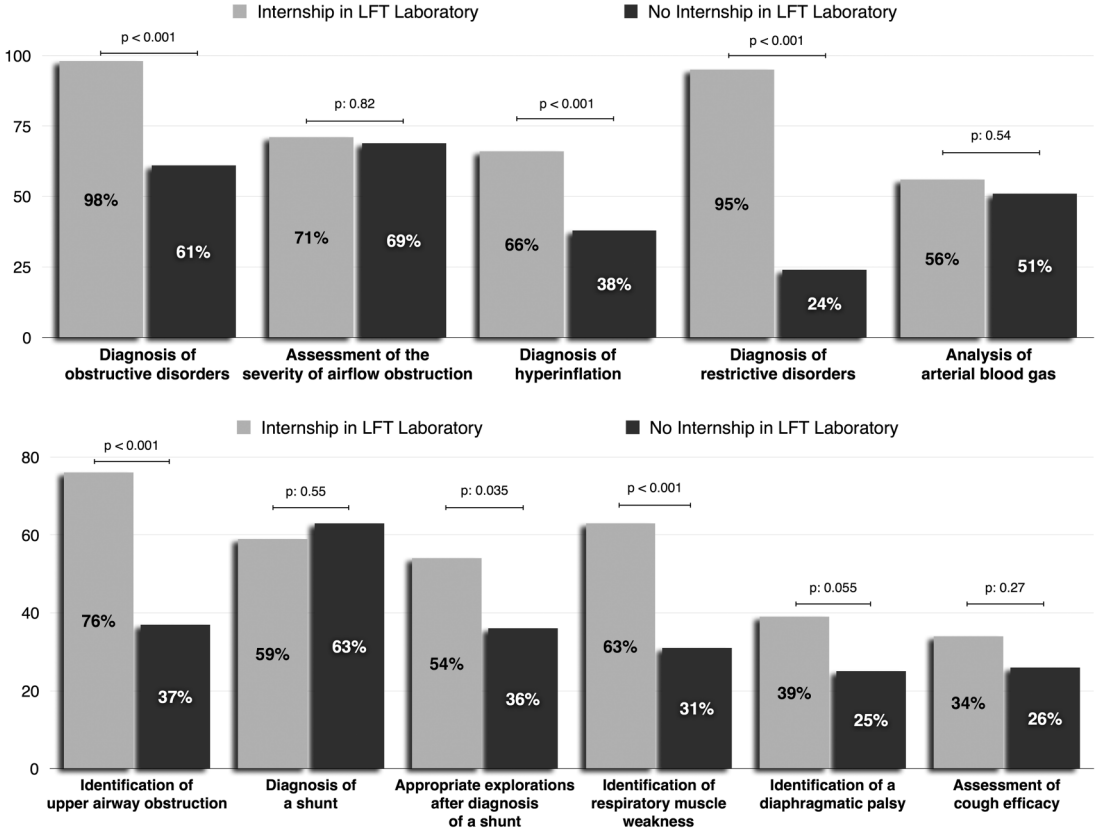

Figure 1 Proportion of correct answers to the questionnaire for the basic and advanced lung function tests (LFT) interpretation.

complete the questionnaire. Trainees had 30 min to answer. In addition to the questionnaire, respiratory residents gave details on their curriculum, on their previous exposure to LFT and on their interest in LFT. A translated version of the questionnaire is available as online supplement 2.

After completion, questionnaires were dispatched to three correctors (Groupe AJPO2/AJIRR: MP, LS, BC). Scoring was performed using the correction grid established by the senior respiratory physicians who designed the questionnaire. For open short questions, the correction grid included the required keywords and acceptable synonyms.

Results are expressed as frequency and percentage or mean and SD. Comparisons were performed using t-test. To identify variables associated to a high total score, we performed a univariate analysis and a multiple linear regression. Regression coefficient corresponding to the change in the total score associated with each variable was calculated. All tests were two-sided; the type I error rate was set at 0.05. Analyses were performed using GraphPad Prism 6 for Mac OS X (GraphPad software, La Jolla, California, USA) and R software V.3.0.1 (Development Core Team, R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0).

RESULTS

In 2014, a total of 369 respiratory residents were in training within one of the seven French academic districts. Six districts with 325 trainees took part in the study. Two hundred and fifty-seven (79%) trainees attended the teaching seminar and answered the questionnaire. Responders had a mean age of 27.1 (±1.9), were female (n:135, 52.5%) and had completed 2.6 (±1.6) semesters in respiratory departments (detailed characteristics of study population can be found in online supplement 1—table S1). Forty-one (16%) responders had done or were doing an internship in a LFT laboratory. The internship in a LFT laboratory was paired to a bronchoscopy unit for 17 (41%) responders and to a ward for 15 (37%) responders. Nine (22%) responders had one full semester dedicated to a LFT laboratory.

Trainees that had a LFT internship had better results to the questionnaire than those who had not: 24.3 (±3.2) vs 21.1 (±4.1) out of 38 ($p<0.001$). Trainees that had a LFT internship had better results in all categories of the questionnaire: technical aspects, basic LFT interpretation, advanced LFT interpretation as compared with those who had not ($p=0.001$, 0.003 and 0.001, respectively) (figure 1). Variables associated to a change in the total score are reported in table 1. In multivariate analysis, an internship in a LFT laboratory was associated with the greatest improvement: +1.74 point ($p=0.017$) of the total score. Hence, trainees that had a LFT internship answered correctly 1.74 (4.5%) more questions out of 38 than those who had not. The number of semesters undertaken in respiratory medicine was

Table 1 Results of linear regression for variables associated with a change in total score to the questionnaire (regression coefficients correspond to the change in score associated to the variable)

	Univariate analysis			Multivariate analysis		
	Regression coefficients	95% IC	p Value	Regression coefficients	95% IC	p Value
Age	0.19	(−0.10 to 0.48)	0.195			
Gender (male)	−0.38	(−1.50 to 0.74)	0.502			
Number of semesters as respiratory resident	0.47	(0.23 to 0.70)	<0.001			
Number of semesters as respiratory resident on respiratory wards	0.67	(0.33 to 0.99)	<0.001	0.67	(0.35 to 0.99)	<0.001
Completion of an internship in LFT laboratory	3.34	(1.89 to 4.80)	<0.001	1.74	(0.31 to 3.17)	0.017
Ranking at final national medical school test						
First 500	Reference					
Between 500 and 1000	−1.58	(−3.53 to 0.38)	0.116	−1.47	(−3.31 to 0.36)	0.114
Between 1000 and 2000	−2.10	(−3.90 to −0.30)	0.022	−1.70	(−3.41 to 0.01)	0.051
Between 2000 and 3000	−4.68	(−6.65 to −2.70)	<0.001	−3.77	(−5.70 to −1.85)	0.001
Above 3000	−4.52	(−6.43 to −2.60)	<0.001	−2.80	(−4.76 to −0.85)	0.005
Region of training						
East	Reference					
Centre	0.47	(−1.63 to 2.58)	0.661	0.37	(−1.70 to 2.41)	0.772
Northwest	−0.79	(−1.13 to 2.92)	0.357	−1.38	(−2.99 to 0.21)	0.090
Paris	2.99	(1.20 to 4.77)	0.001	0.82	(−1.15 to 2.79)	0.412
South	2.29	(0.35 to 4.21)	0.020	1.92	(0.03 to 3.81)	0.049
West	0.90	(−1.13 to 2.92)	0.385	−0.26	(−2.15 to 1.64)	0.790
Self-assessed knowledge of LFT at the end of medical school						
No knowledge	Reference					
Minimal knowledge	3.37	(0.82 to 5.91)	0.010	1.87	(−0.51 to 4.24)	0.122
Basic knowledge	3.62	(1.14 to 6.10)	0.004	1.63	(−0.71 to 3.96)	0.171
Good knowledge	3.75	(1.04 to 6.46)	0.007	1.97	(−0.58 to 4.53)	0.131
Interpretation of LFT outside a dedicated internship (yes)	1.79	(0.64 to 2.94)	0.002	1.06	(−0.00 to 2.11)	0.051
Attendance to theoretical training on LFT interpretation organised by the academic district (no)	−1.95	(−3.17 to −0.74)	0.0017	−0.73	(−1.97 to 0.51)	0.247
Attendance to theoretical training on LFT interpretation not organised by the academic district (conference, private training, etc) (yes)	1.11	(−0.07 to 4.96)	0.103			
Read at least one textbook on respiratory physiology (yes)	−0.14	(−1.34 to 1.06)	0.819			

LFT, lung function tests.

associated with an improvement of the total score (+0.67point, p=0.001). A low ranking after the sixth year medical school final exam was associated with a lower total score. After adjustment on the previous variables, self-assessed good knowledge of LFT after medical school and LFT interpretation outside a dedicated internship were not significantly associated to a higher score.

DISCUSSION

Our results show the benefit of an internship in a LFT laboratory in order to improve trainees' ability to interpret LFT.

We have previously shown that apprehension to provide adequate management of patients was the first cause of anxiety for French respiratory residents.[6] Here, we confirm this result as only 17.9% of our respiratory trainees thought that they would be able to interpret all LFT at the end of their training. This lack of confidence can be partially explained by the short length of current training (see online supplement 1) and by a limited access to practical training. As most of respiratory trainees cannot access a placement in a LFT laboratory, their skills for LFT interpretation mainly rely on their initial training and on their ability to attend a LFT laboratory on top of their rotations in medical wards. However, trainees that performed LFT interpretation on top of their additional rota did not significantly improve their score. This result is in line with the feeling of UK respiratory residents for their training on interstitial lung diseases.[7]

We have shown that doing more placements in respiratory wards significantly improved the score to the questionnaire. This result suggests a learning benefit of the respiratory training itself. However, this benefit is lower than a dedicated internship in a LFT laboratory. Interestingly, most of the residents that had a placement in a LFT laboratory had shared a placement between the LFT laboratory and a bronchoscopy unit or a respiratory ward.

We have shown that an improvement of the theoretical training could improve results to our questionnaire. In Europe, HERMES curriculum[1] can be considered as the gold standard for theoretical training. The only academic district (South) that had implemented this curriculum[1] had significantly better score.

Our study has several limitations. Twenty-one per cent of French respiratory residents did not attend the teaching seminar. This can be explained by duty of care in order to ensure continuity of care in the hospitals. We do not think that this would have led to a selection bias as residents on duty of care are usually randomly chosen. Another limitation of our results is the main judgement criteria used. Indeed, our study shows that an internship in a LFT laboratory improves results to the questionnaire which may not necessarily translate in clinical practice. However, the low rate of good responses, especially for the diagnosis of obstructive disorder, suggests that insufficient training in LFT interpretation could have clinical consequences with erroneous diagnosis or inadequate drug administration. The lack of a pre-existing validated questionnaire to assess LFT skills explains why we developed our own questionnaire.

Our results highlight the benefit of an internship in a LFT laboratory, but more studies are required to determine the most efficient way to provide high-quality training in LFT. We suggest that European experts produce specific guidelines for LFT training. We also propose benchmarking between European countries with different modalities of practical training to evaluate the generalisability of our results. Finally, we recommend a reform of current French respiratory training in order to widen access to a placement in a LFT laboratory.

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