Survey of knowledge of simple pulmonary function tests (PFTs) amongst trainee doctors in England

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The understanding of and interpretation skills for simple pulmonary function tests (PFTs) are increasingly required in the everyday practice of medicine. This knowledge was evaluated amongst the trainee hospital doctors in the north-east of England.

Three-hundred questionnaire sets were sent in the post to the relevant junior doctors working in the north-east of England and sixty-nine completed sets were returned; a raw response rate of 23% and a corrected response rate of 27%.

There were deficits in knowledge and confidence in most tests except for those which were most commonly used, and this was noted across the different grades of junior doctors.

The respondents were aware of the deficiency and most would like further teaching and input during their hospital career. An appropriate plan for improvement should be formulated and implemented.

Introduction

Pulmonary function tests (PFTs) are becoming increasingly common (1) in hospital practice, and it is important to have a good working knowledge of these widely used investigations in order to practise medicine effectively. Traditionally, PFTs are taught almost exclusively in the undergraduate medical curriculum and there is little, if any, structured teaching and training afterwards. However, after graduation, junior doctors are faced for the first time with ordering and interpreting these tests and the need and opportunities for further training and feedback may be greatest at this stage. This survey was conducted to assess the current state of knowledge and relevance of simple PFTs, and their proper application in common clinical situations by trainee hospital doctors. The study also aimed to recommend appropriate changes in training and educational planning based on its findings.

Methods

We evaluated the understanding of simple PFTs amongst junior hospital doctors (defined as ranks from House Officer to Senior Registrar involved with acute unslected medical/geriatrics admissions) through a postal questionnaire survey. A total of 200 questionnaire sets were sent to all the relevant hospitals in the north-east of England (under the Northern Deanery) during the second half of January 1997. The doctors were asked to return the survey to their respective postgraduate centre manager within 2 weeks.

Sixty-nine (69) completed questionnaires were returned; a raw response rate of 23% and a corrected response rate of 27% (taking account of those on leave or sick which was approx. 15%). The response rate was low, but a higher rate than this from a postal survey (and without any reminder) amongst junior hospital doctors would be unrealistic.

The simple PFTs included eight commonly performed tests in hospital practice as follows: peak flow measurement peak expiratory flow (PEF), Vitalograph [forced vital capacity (FVC) and forced expiratory volume in 1 sec (FEV1)], arterial blood gas analysis (ABG), flow volume loops, lung volume measurement, gas diffusion, the skin test and the exercise test (for assessing pulmonary function). For easy identification and differentiation, the peak flow measurement and Vitalograph tests were assessed separately. These two, together with ABG analysis, were the most commonly performed PFTs. Of the rest, flow volume loops, lung volume measurement and gas diffusion are somewhat less common, but still formed an essential component of a full PFT. The skin test was added as it is commonly carried out in patients with asthma and other allergic disorders. The exercise test, for many, is an assessment of cardiac function only, but this is far from true. This test was included to investigate whether juniors were aware of its respiratory indications, such as assessment of
desaturation during exercise, measurement of maximum workload and oxygen consumption and evaluation of exercise-induced asthma. Other lung function tests, such as methacholine challenge for bronchial lability, or sniff pressure measurement for assessing diaphragmatic function, are not used in routine practice and so were excluded.

Junior doctors (trainee doctors) were defined as anyone ranking from house officer to senior/specialist registrar working in hospitals in the north-east at that time. However, the questionnaires were sent only to those juniors involved in acute unselected medical/geriatrics admissions. The questionnaires were sent towards the end of a 6-month term so that every doctor had at least several months of experience in medicine/geriatrics before being asked to reply to these questionnaires.

The questionnaires were divided into three sections. The first part (self-assessment section) dealt with subjective assessment of the various pulmonary function tests (PFTs) described above. The qualitative response categories for this section were as follows: good=accurate and confident in interpretation, does not require help from others for interpretation; average=right most of the time, but requires others to help at times for interpretation; poor=not confident of correct interpretation, needs others to help most of the time. The second part (opinion section) enquired about the usefulness of the tests in hospital practice, whether or not the junior doctors had any formal teaching, and any need for further training and input. The answers in this section were descriptive. The final part of the questionnaire assessed knowledge of simple PFTs in clinical situations through a set of four multiple-choice questions (MCQs).

Of the 69 respondents, 23 were house officers (HO) and 46 were more experienced junior doctors (senior house officers, registrars and senior registrars). A comparison in understanding between the two groups was made using the chi-squared test with Yates' correction as appropriate (2).

### Results

Most of the respondents indicated good knowledge of the three most commonly performed tests: peak flow measurement (PEF), Vitalograph (FVC and FEV₁) and arterial blood gas analysis. However, they had only average or poor understanding of flow volume loops, lung volume measurements, gas diffusion, skin tests (for allergens) and exercise tests (for assessing pulmonary function). Fig. 1 summarizes the results.

With regards to the second section, most doctors (93%; n=64) had undergone undergraduate teaching on pulmonary function tests, but less than one-third (30%) had any teaching or formal training during their hospital work. Most (93%) would like to have further teaching and input during their hospital career. Many of the respondents (78%, n=54) thought that knowledge of PFTs was very helpful or helpful, but did not think (68%, n=47) that being deficient in knowledge ever hindered or delayed patient care in their experience. Very few people (10%, n=7) used the exercise test in assessing pulmonary function. Table 1 shows the results of the questionnaire.

In the multiple-choice section, a mean of 91% (n=63) of respondents were able to indicate correctly the distinguishing feature between obstructive and restrictive lung functions, the diagnostic test for respiratory failure and the relevance of the skin test in diagnosing asthma. However, over two thirds (70%, n=48) had difficulty in identifying the most appropriate PFTs to distinguish between emphysema and other chronic obstructive pulmonary diseases (COPDs). Figure 2 summarizes the results.

When we looked at the eight different pulmonary function tests separately, there was an overall trend of better comprehension in more experienced junior doctors (n=46) compared to the house officers (n=23). This was not statistically significant except in the Vitalograph and gas diffusion tests, as shown in Table 2.
Table 1. Training and relevance of pulmonary function tests (n=69 respondents)

<table>
<thead>
<tr>
<th>Already undergone formal teaching</th>
<th>Would like further teaching</th>
<th>Relevance to practice</th>
<th>Patient care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate curriculum (UGC)</td>
<td>During hospital training</td>
<td>Others (UGC, course)</td>
<td>Very helpful/helpful</td>
</tr>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>64</td>
<td>41</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>22</td>
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</tr>
<tr>
<td>48</td>
<td>48</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>Y Yes, N No.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Y=Yes, N=No.

However, when all eight tests were analysed together, the results showed a significant difference between the more experienced group of junior doctors and the house officers ($\chi^2=8.11; P=0.004$; odds ratio=0.564; 95% CI=0.38-0.83). There was no statistically significant difference in performance between the two groups in MCQs analysed either separately or together.

Discussion

This survey showed a significant deficiency in knowledge and confidence in all the simple PFTs except the three most commonly performed tests amongst junior doctors. However, they performed relatively well in the MCQ section. A comparison with other similar studies could not be made, as no relevant references were available in the literature.

An obvious deficiency of the survey was the low response rate. No reminders were sent, as many of the target doctors would have subsequently moved to a new post. However, the response rate from postal questionnaire surveys (PQS) without follow-up is known to be low (3), and this is particularly true when involving junior doctors, who are a large 'floating' group in the National Health Service (NHS) with a short-term contract of employment. In a recent paper by Greenwood et al. (4), the completed response rate from PQSs was 31%. Although the poor response rate is realistic, there is little doubt that this tempers the results of the survey. It may be argued that those who were more knowledgeable about the tests actually made an effort to respond. On the other hand, one could also suggest that those who were least confident about it felt that they ought to try the questionnaire and assess themselves in a more structured way and therefore responded. It may be the motivation rather than the knowledge which influenced the response rate. In any case, the potential for bias as a result of the low response rate cannot be disregarded.

The type of questionnaire used in this study has been widely validated and found to be generally reproducible. Both of the tools (self-assessment and a MCQ section) used here were designed with respect to content, construct and criterion validity so that they were representative of the knowledge and application of the knowledge being tested. In medicine, self-assessment questionnaires have been found to correspond closely with peer evaluation (5) or a structured interview (6). On the other hand, MCQs are the most consistent, reproducible and internally reliable method of testing recall of factual knowledge. Besides recall, MCQs also test understanding, reasoning ability and the application of knowledge based upon principles. However, the cueing effect (7) in MCQs is a recognized problem, and various solutions to this have been proposed (8).
TABLE 2. Differences between house officers (HO, n=23) and more experienced junior doctors (>HO, n=46)

<table>
<thead>
<tr>
<th>Pulmonary function tests (PFTs)</th>
<th>Good knowledge Ho</th>
<th>Average/poor knowledge Ho</th>
<th>Good knowledge &gt;Ho</th>
<th>Average/poor knowledge &gt;Ho</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitalograph*</td>
<td>10</td>
<td>38</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Gas diffusion†</td>
<td>0</td>
<td>15</td>
<td>23</td>
<td>31</td>
</tr>
<tr>
<td>All eight PFTs together</td>
<td>51</td>
<td>149</td>
<td>133</td>
<td>219</td>
</tr>
</tbody>
</table>

\*χ² (with Yates’ correction) = 9.3; P = 0.002; odds ratio = 0.162; 95% CI (confidence interval) = 0.05-0.50.

\‡χ² (with Yates’ correction) = 7.76; P = 0.005; odds ratio = 0.043; 95% CI = 0.01-0.51.

As the results showed, a mean of 77% of the doctors (n=53) were confident about the three commonest PFTs, namely PEF, FVC and FEV₁, and ABG analysis. However, only 12% of the respondents (n=8) were confident about the other five less widely performed tests. Although most had undergone undergraduate teaching in PFTs at medical school, an overwhelming majority (93%, n=64) indicated that they would like further teaching and input during their hospital career.

House officers (9) and senior house officers (SHOs) in the U.K. are allocated protected educational time of half a day (4 h) per week. In most institutions, at least 1 h of this is spent in teaching sessions. This time could be used to improve understanding of PFTs. In fact the Core Curriculum (10) for SHOs stresses that knowledge of lung function tests is an essential practical skill for trainees. Obviously, this recommendation is not being followed closely, as 70% of the respondents confirmed that they had no further teaching in PFTs during their hospital training.

With the current demographic changes towards an aging population, and the increased availability and sophistication of respiratory equipment, more PFTs are ordered and performed today than ever before (1). Unfortunately, despite their increased use, there has been no concerted effort to improve understanding of these tests amongst junior doctors in general. Hands-on training in the hospital, and attendance on an outside course, may not be a practical or cost-effective way of improving knowledge of PFTs in the majority of trainee doctors. In-hospital taught sessions with feedback may be the best option, but this will need further evaluation. Critics may argue that not all junior doctors require extra teaching in this field because of other priorities. This may be true, but the vast majority of junior doctors aiming for different medical specialities and general practice would benefit from good knowledge of PFTs.

Even though the survey was performed only in one area, the findings and implications may be relevant not only for the U.K. but also in Europe and beyond. Both academics and medical curriculum planners should be made aware of this deficiency.

Conclusion

Although the response rate was low, it is probably fair to say that there is a good understanding of the few most commonly used PFTs, but not of most others. The deficiency is noted across the grades of experience. Most junior doctors would like and probably need further teaching during their hospital training. Serious consideration should therefore be given to increasing input during hospital training. In the U.K., one option may be to include PFTs as a regular topic in the taught sessions.

Acknowledgements

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References
