Self-assessment of medical knowledge: do physicians overestimate or underestimate?

ABSTRACT—The relationship between doctors' medical knowledge and their inability to assess correctly what they know was investigated. Sixty out of 65 hospital physicians sat a MRCP Part 1 multiple-choice examination. In addition to the factual questions, they had to estimate how certain they were that their answers were correct. We confirmed that factual knowledge increased with clinical experience from the grade of house officer through to that of senior registrar. The self-assessment of likelihood of being correct revealed that, on average, doctors underestimated their knowledge by 8%. However, those who had passed their MRCP examination within the past three years overestimated on average by 6%. We suggest that this inadequacy of self-assessment could have serious clinical implications, and should be assessed.

It is self-evident that a doctor must have sufficient factual knowledge to make decisions regarding the management of patients. However, in practice it may be equally important to the patient that the doctor should be able to assess correctly what he knows and what he does not know.

Some may overestimate and some may underestimate their knowledge, the former probably being more a cause for concern than the latter. This study was designed to test the levels of knowledge of hospital physicians, from house officers to senior registrars, and to compare each individual's score with his own estimate of the accuracy of his answers.

Subjects and methods

Ninety hospital physicians working in Dundee hospitals were approached individually and asked to complete a true/false choice paper of 100 questions. The questions and correct answers were taken from the *Oxford textbook of medicine* MRCP MCQ question-book.

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None of the 20 consultant physicians approached returned completed questionnaires, but only five out of 65 junior physicians failed to complete the examination paper. The volunteers comprised 15 preregistration house officers, 14 senior house officers, 12 registrars with less than five years' experience since graduation, 10 registrars with more than five years experience, and 9 senior registrars. Registrars with more than five years experience were separated from the more junior registrars because they were eligible to perform certain legal duties, such as completion of the second part of cremation certificates, which junior colleagues may not do.

All registrars had passed the MRCP clinical examination in their third year since graduation. None of the senior house officers had taken their MRCP clinical examination at the time of study.

All participants were requested to indicate beside each answer an estimate of their mark, on a scale from 0 to 100, according to their belief in the correctness of their answer (0 indicating complete lack and 100 absolute certainty that the answer was correct). Candidates spent approximately 20 minutes completing the questions and afterwards sealed the examination paper in an envelope to ensure anonymity. All papers were marked by one physician. Each individual was given a final factual mark based on his number of correct answers, and a final mark of his estimates by dividing the aggregate of all his estimated marks by 100.

Statistics

The significance of the difference between the proportion of doctors in the seniority groups who either underestimated or overestimated their marks was assessed by the chi-squared test.

Results

Table 1 shows, according to their seniority, the numbers of doctors who obtained a score higher (underestimators) or lower (overestimators) than they had estimated for themselves. In each group there were some doctors who overestimated their factual score; but there were considerably more overestimators among registrars with less than five years experience. The differences between the five groups in the proportions of overestimators were statistically significant (chi-squared for four degrees of freedom = 12.4. $p = 0.015$).

The score of factual knowledge increased stepwise according to clinical experience (chi-squared for four

degrees of freedom = 9.6; $p < 0.05$ (Table 2)). However, it is apparent that on average doctors underestimated their knowledge by approximately 9% (Table 2). Underestimation was seen in the house officers, senior house officers, registrars with more than five years experience since graduation and senior registrars. In contrast, registrars with less than five years experience since graduation overestimated their actual marks on average by 6%. Within the latter group, 73% of first year registrars were overestimators, and this proportion dropped to 57% for third-year registrars. It is difficult to exclude the effect of random variation because of the small numbers involved. However, many registrars continue to overestimate their knowledge for three to four years after passing the MRCP clinical examination. Registrars three years after the MRCP examination (six years since graduation) gave the largest overestimate of their knowledge: 10.5%.

Table 3 indicates that on average doctors were wrong in approximately a quarter of answers they thought had a chance of being 90–100% correct. This category of questions was taken to indicate an absolute or very strong belief in the correctness of an answer. The registrars with less than five years experience appeared to be more decisive because they answered 44% of the examination paper with strong or absolute certainty of being correct. Despite this confidence they were wrong in 25% of these questions. Senior registrars were most often correct when they were certain of the answer, being wrong in only 14% of these questions.

Discussion

The examination paper was based upon multiple choice questions (MCQs) taken from those in the *Oxford textbook of medicine* MCQ book. Although we believe that no MCQ paper can comprehensively test clinical knowledge, we consider that this was the best choice for this study. In addition, this is the examination format used by the Royal College of Physicians to assess clinical knowledge for the first part of their clinical examination. We do, of course, acknowledge that the MCQ form has limitations, as in any such paper some answers may be open to further debate; this factor is common to all candidates.

This study found that, as expected, factual knowledge increases with clinical experience from house officer to senior registrar. However, there was no obvious effect of the MRCP examination on the factual scores. There was little difference between those about to take Part 1 (senior house officers) and those who had just taken it (registrars with less than five years experience). It was the more experienced registrars and senior registrars who had the high scores.

The self-estimate of knowledge shows a different pattern according to seniority from the factual scores. On average, doctors underestimated their knowledge by 9%. However, registrars with up to five years experience (equivalent to up to three years in the registrar

Table 1. Proportions of doctors who underestimated or overestimated (The grades of doctors were subclassified as under-estimators or overestimators according to whether their factual or their estimated score was the greater)

Grade of doctor	Number who underestimated	Number who overestimated	Total
House officer	11	4	15
Senior house officer	11	3	14
Registrar, < 5 years experience	3	9	12
Registrar, > 5 years experience	6	4	10
Senior registrar	8	1	9

Chi-squared; $p = 0.015$

Table 2. Estimated marks and factual marks according to clinical experience (The grades of doctors have their mean factual and estimated marks tabulated)

Grade of doctor	Number of subjects	Mean factual mark (%)	Mean estimated mark (%)
House officer	15	63 [46–69]	56.5 [40–71]
First-year senior house officer	6	64 [54–75]	50.1 [40–72]
Second-year senior house officer	8	65 [49–76]	58.5 [51–74]
Registrar, < 5 years experience	12	66 [51–75]	72.3 [58–89]
Registrar, > 5 years experience	10	70 [55–78]	61.1 [56–72]
Senior registrar	9	74 [67–79]	65.5 [63–69]
Average	60	67	61.5
Significance level (*p* value)		< 0.05	< 0.05

[   ] = range

grade) overestimated their knowledge by an average of 6%. Furthermore, these registrars answered on average 44% of the paper with strong or absolute certainty that their answers were right. In these questions they were wrong on average 25% of the time. In contrast, senior registrars who scored best on factual knowledge were wrong least often on the 'absolutely certain' answers. Thus senior registrars not only know more but also have a more accurate assessment of their own knowledge when answering emphatically. In addition, when they are uncertain they strongly underestimate their knowledge, ie < 80% certainty (data not shown). In this sense they perceive that they either 'know it or don't know it'.

These findings suggest that there may be a 'confidence boost' after the MRCP examination leading to overconfidence in registrars, which persists for up to three years. Most other doctors in training grades underestimate their knowledge.

The important question is: does this failure to self-assess knowledge matter clinically?

Underconfidence may be preferable because the doctor may be more inclined to check facts before acting, whereas the overconfident doctor will not. But underestimation of knowledge may also create problems. It could lead to inappropriate investigations for patients, long laborious clerking delays in seeing patients, and failure spontaneously to institute appropriate management.

These situations seem all the more likely to arise when assessing individuals rather than groups. One registrar of less than five years standing had a factual mark of 59% despite being certain that he had 89% of the paper correct. On the other hand, a senior house officer scored 71%, yet estimated his mark to be 49%. Clearly the latter has better factual knowledge but less confidence but, given the hierarchical structure, it is distinctly possible that he would turn to the former registrar for advice . . . 'The blind leading the not so blind'!

Table 3. Analysis of the questions in which the doctor was certain that he had answered correctly.

Years since graduation	Mean number of times the individual used 90–100% in his estimated mark	Number of times wrong (%)
House officers	28	7 (25%)
Senior house officers	24.5	7 (28%)
Registrars, < 5 years experience	44	11 (25%)
Registrars, > 5 years experience	35	7 (23%)
Senior registrars	35	5 (14%)
Average	32.5	8 (24%)

In many instances the training of junior hospital doctors has been reported to be unsystematic and ineffective [1,2]. Moreover, there is no regular audit of the success of teaching and courses [3]. This article highlights a potential area for improving future training and assessment of doctors. Doctors should be taught to recognise both over- and under-confidence in themselves as a standard part of their training. This inadequacy of self-assessment may be potentially dangerous in the clinical context, although this area merits further research.

References

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