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Chapter 35

Student selection

I. C. McManus

Introduction

Selection seems deceptively easy; with more applicants than places, one simply selects the best applicants. In practice the process is much more complicated and may be:

- of dubious validity
- statistically unreliable
- a vulnerable process within the medical school
- open to legal challenge on grounds such as discrimination
- criticised by society at large
- under-resourced, particularly when compared with a medical school's implicit expectations of what it can do.

Why select?

A selection programme must clearly state the reasons for selection. If the only reason is reduction of numbers a lottery-type process would suffice. In reality selection is a complex process with several different stages.

Selection of students by the medical school

The straightforward reason is to choose the best students. Although seemingly simple, this contains many complexities.

Selection by applicants of medicine as a career

The pool of applicants for medical schools to choose from consists only of those who have selected medicine



"Selection is of key importance to medical education. What sort of students are recruited at the beginning is a major determination of what kind of doctors come out at the end"

Downie & Charlton 1992



"although there are reasons for being anxious about medical school selection, not all of the blame can be laid at the door of the selectors. Self-selection and preselection out of the applicant pool is extensive"

Johnson 1971

as a career. The majority of the population who did not apply cannot be selected, even if they might make excellent doctors.

Selection of the medical school by applicants

Applicants study *all* medical schools and then choose which to apply to. There is no point in running a good selection system if most good applicants have already applied elsewhere. An effective selection system must encourage the best students to apply to a school.

Explicit selection of medical schools by applicants

Applicants receiving offers from several medical schools make an explicit choice and select one from those on offer. McManus et al 1999 have shown that schools which interview are twice as likely to be preferred to schools which do not.

Selection for a particular course

Increasingly medical schools are developing courses with different emphases. A course, for example, with a large component of problem-based learning in small groups might choose to select students who can work together in a cooperative rather than a competitive fashion.

Selection by staff

If staff have been actively involved in the selection process and have met the students as applicants a relationship can develop which can enhance the educational process. Staff feel ownership of selection and students feel membership of the institution.

The limits of selection

There is a fundamental misconception that medical schools receive numerous applications. In practice the ratio in the UK is about two applicants for every place, although from the perspective of admissions officers it may seem much more than that, because each candidate makes multiple applications. The power of selection depends to a large extent on the 'selection ratio', the



"The aim is not to pick men and women for specific tasks but to train wise, bright, humane, multipotential individuals who will find their niche somewhere in medicine"

Richards & Stockill 1997

number of applicants for each place. As the ratio grows, so selection can be more effective.

The limits of selection can be shown in a straightforward mathematical model. For example, if selecting on a single criterion (such as intellectual ability), assuming that this ability has a normal distribution and that the selection ratio is two applicants for every place the optimal selection is as shown in Figure 35.1. Place the candidates in rank order and take those above the median.

The limits of selection appear when two or more criteria are introduced. For example, if selecting on two independent (orthogonal) criteria (intellectual ability and communication skills) there will now be a bivariate normal distribution (see Fig. 35.2) and the aim is to take the best 50% of candidates on the joint criteria. The dashed lines indicate the means of the distributions, which would be the threshold if there were only one characteristic.

There are several ways to select the best 50%, according to the extent to which high ability on one criterion can compensate for poorer performance on the other, though all have similar effects (McManus & Vincent 1993). If selected candidates have to be above a certain threshold on *both* criteria they must be in the top right-hand corner of the figure. The important thing is that the threshold on either criterion must be substantially below the median. In fact, with two independent criteria, candidates selected are only in the top 71% of the ability range, rather than the top 50%. Therefore they are less able on average on either criterion than if it had been the sole criterion.

So if one selects principally on just one attribute, and wishes to select also on a second attribute, it is necessary to reduce one's criterion on the first attribute. In the UK medical student selection is currently based predominantly on academic achievement. If it is felt desirable to take non-academic factors into account then current academic standards will have to be lowered.

Once medical schools have started considering non-academic attributes for selection then they rapidly

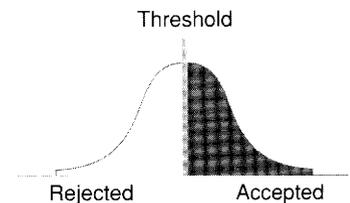


Fig. 35.1 A simple model of selection when there is a single characteristic on which selection is taking place. Those above the threshold are accepted, those below are rejected

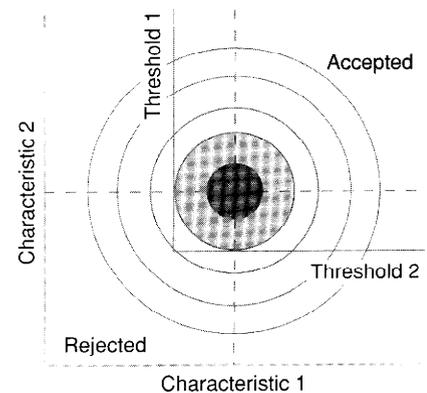


Fig. 35.2 Example showing joint criteria

Table 35.1 The effects of selection on multiple criteria (McManus & Vincent 1993)

<i>Number of independent selection criteria</i>	<i>Proportion of applicants rejected on any single criterion</i>
1	Bottom 50%
2	Bottom 29.3%
3	Bottom 20.6%
4	Bottom 15.9%
5	Bottom 12.9%
6	Bottom 10.9%
10	Bottom 6.7%
20	Bottom 3.4%
50	Bottom 1.4%
N*	Bottom $100 \cdot (1 - \frac{1}{N})\%$

* N = number of criteria: r = selection ratio (i.e. 1/r is the proportion of applicants accepted).

develop a long list. Even if these are not all statistically independent, one rapidly ends up with a system with 5, 10, 20 or even 50 statistical dimensions. Extending the selection process (see Figure 35.2) to three, four or five criteria and so on shows how the limits of selection rapidly appear. In Table 35.1 the proportion of candidates eliminated on a single criterion (shown in the second column) becomes smaller as the number of criteria rise. The criteria are assumed to be independent, and the selection ratio to be two (i.e. 50% of candidates are selected). To summarise it pithily, 'if one selects on everything one selects on nothing.' Therefore:

- Selection should aim at a relatively small number of what we will call 'canonical traits'; the three or four characteristics which are likely to be predictive of future professional behaviour and can be assessed reliably at the time of application to medical school.
- Schools where selection is currently based almost entirely on academic ability will have to reduce those academic standards if they wish also to select effectively on non-academic criteria.
- Selection should be recognised as being very limited in its power. The really powerful implements for effecting change are education and training (McManus & Vincent 1993).

What are the canonical traits which should be selected for?

Four principal canonical traits for selection have been identified (McManus & Vincent 1993).

Intelligence

Doctors probably cannot be too intelligent. Meta-analyses of selection across a wide range of different occupations at all social levels show that the best predictor of both job performance and the ability to be trained is intelligence (Schmidt & Hunter 1998).

Learning style and motivation

University students in general are motivated to study for different reasons and adopt different study habits and learning styles which are consistent with that motivation. Table 35.2 summarises the typology of Biggs (Biggs 1987, Newble & Entwistle 1986). Deep and strategic learning (but not surface learning) are both compatible with a self-directed, self-motivated approach to learning, which is likely to result in the life-long learning necessary of modern practitioners.

Communicative ability

The majority of complaints about doctors involve problems in communication so it makes some sense to

Table 35.2 Summary of the differences in motivation and study process of the surface, deep and strategic approaches to study (based on the work of Biggs 1978, 1985, 1987, 1993)

Style	Motivation	Process
Surface	Completion of the course	Rote learning of facts and ideas Focusing on task components in isolation
	Fear of failure	Little real interest in content
Deep	Interest in the subject	Relation of ideas to evidence
	Vocational relevance	Integration of material across courses
	Personal understanding	Identification of general principles
Strategic	Achieving high grades	Use of techniques that achieve highest grades
	Competing with others	Level of understanding patchy and variable
	Being successful	



"A' levels tell us nothing about some of the most desirable attributes of the doctor. The four desiderata are technical competence, human sympathy, wisdom and experience"

McKeown 1986

include it in selection. Although communication skills should have been developing during life they can be further refined. However, individuals who are communicating poorly at age 17 are less likely to respond well to training. Assessment is not straightforward but questionnaires are available (McManus, Kidd & Aldous 1997).

Conscientiousness

The meta-analysis of Schmidt & Hunter (1998) showed clearly that the best predictor of job performance and trainability, after taking intellectual ability into account, was integrity or conscientiousness. Conscientiousness is one of the five personality dimensions assessed in the 'Big Five', which together account for the majority of important variations in personality (Matthews & Deary 1998), the other four being extroversion, neuroticism, agreeableness and open-mindedness. Conscientiousness probably gains a large part of its impact through the simple fact that highly conscientious people tend to work harder and be more efficient, and thereby gain more and better experience.

Surrogates for selection

Although intelligence, learning style and motivation, communicative ability and conscientiousness should probably form the basis of selection, it is sufficient to select on other measures which correlate highly with them. Selection on school-leaving examinations is one surrogate as high grades correlate to some extent with level of intelligence, appropriate learning styles and a conscientious approach to study. Of course a person of lower intellect may pass exams by prodigious rote learning, conscientiously carried out, but it is relatively unlikely. Playing in an orchestra or for a sports team can imply conscientiousness at practising, an ability to communicate well with other individuals when collaborating on an enterprise, and perhaps a certain interest in the deeper aspects of a skill (intrinsic motivation). Good selection processes should not use such surrogates uncritically, but should ask what

underlying psychological traits this biographical data (biodata) is purporting to assess.

Methods and process of selection

The process of selection and the methods used to carry it out are entirely separate (Powis 1998). Medical schools should have a selection policy which clearly states how selection takes place, how appropriate information is collected, and how a decision will be made based on that information. Once the information has been acquired the selection policy can be implemented and a decision made. This decision-making should be an entirely administrative process. Although seemingly absurd at first sight, this ensures good practice and avoids suggestions of discrimination or unfairness, or apparent inconsistencies in selection. The academic and educational input to the system should be in deciding the protocol and, where necessary, making subtle judgements about the information (such as evaluating aspects of the application form or interviewing). A corollary of the principle is that the separate items of information should be assessed separately. If interviewers are asked to judge a candidate's knowledge of medicine as a career then that is what they should do; they do not need information about interviewees' GCSE or 'A' level results, hobbies or so on as this information can result in a halo effect on the judgement interviewers are required to make.

Assessing methods of selection

There are many methods of selection, each of which has its strengths and weaknesses. Each may be assessed in terms of:

- **Validity.** All assessments in selection are implicit predictions of the future behaviour of a candidate. If there is no correlation with those future behaviours then they are not useful, however much assessors may agree about them.
- **Reliability.** If selectors disagree about a characteristic, or re-assessment gives different answers, then the information is unlikely to be useful.



"A multitude of ad hoc policies implemented by miscellaneous admissions officers of various medical schools cannot be properly evaluated or criticized, and is open to considerable abuse. Selection itself is problematic enough, without trying to make it a panacea for the world's ills. If selectors are trying to do too much too well, they will end by failing to do anything properly"

Downie & Charlton 1992

- **Feasibility.** Assessments can usually be made more reliable and more valid by extending them. The result is greater cost, financially or in staff time, the gain from which may not be worth the resource expended.
- **Acceptability.** Candidates and their teachers, friends and relations must feel that selection methods are appropriate.

Different methods of selection

Administrative methods

A method typically used by office staff, processing information from application forms is relatively objective and is mostly used for rejecting candidates. It is usually reliable, cheap and acceptable but of uncertain validity.

Assessment of application forms

Application forms often contain unstructured personal statements and referees' reports, which must be assessed by a shortlister who attempts to determine a candidate's motivation and experience of medicine as a career. Like interviewing, it is subjective and often of moderate or even poor reliability and of uncertain validity. It is, however, cost-effective and acceptable to applicants. Reliability can undoubtedly be improved by training and the use of structured assessment protocols, clear criterion referencing and careful constructed descriptors of the various characteristics to be identified.

Biographical data (biodata)

This can be assessed either indirectly from an open-ended application form (e.g. the 'personal statement') or more reliably from a specially designed structured or semi-structured questionnaire. It derives its usefulness from the psychological principle that the best predictor of future behaviour is past behaviour. It is usually reliable, valid (Cook 1990), cost-effective and acceptable to applicants.

Referees' reports

These can be useful if they are totally honest, but referees often feel a loyalty to the candidate rather than the medical school. Experienced head teachers will say that they expect medical schools to 'read between the lines', so that it is not what is said that matters, but what is left unsaid or understated. Such an approach inevitably means reliability is low, validity very dubious and acceptability ambiguous. They are expensive in terms of referees' time but not the medical school's.

Interviewing

Only about two-thirds of UK medical schools hold interviews, suggesting genuine uncertainty about their usefulness. They can, however, be more reliable than suspected. Marchese & Muchinsky (1993) report that reliability and validity are mostly dependent on training of interviewers and on a clear structure. Behavioural interviewing, where the emphasis is upon how the candidate has behaved in concrete situations in the past, is usually more effective than interviews asking about hypothetical situations in the remote future. Although expensive in terms of staff time, interviews are highly acceptable to the general public who are not happy with doctors being selected purely on academic grounds. However, they are often criticised after the event by candidates, parents and teachers.

Psychometric testing

Typically this involves questionnaires for assessing motivation and personality, timed assessments of intellectual ability or psychomotor tests of manual dexterity. The validity of these tests has often been formally assessed with regard to jobs in general and undoubtedly they are very reliable if well developed. However, they are time-consuming to administer and may be unpopular with candidates, who may feel that there are 'trick' questions and that the characteristics being assessed are not necessarily relevant to a career in medicine.



"There is a most odd tendency on the part of the British selectors to accept the headmaster's report as 'extraordinarily accurate', except in some particular instances, which the selectors seem to assume they can always recognise. This is part of a general delusion of selectors; that they are able to use imperfect materials such as other people's opinions (or, in the case of some headmaster's reports, other people's opinions of other people's opinion) but somehow, miraculously, in their hands, these base metals are transmuted in the finest gold"

Simpson 1972

"Prolonged observation of candidates in different situations by trained selectors makes the final . . . decision relatively easy. This contrasts with the brief interviews done by . . . medical schools where dubious decisions are often based on inadequate evidence. The experience of assessment centres is that early opinions may be suspect . . . The time has come to establish on an experimental basis a Medical Selection Board along the lines of the assessment centres of the Army, Civil Service and British Airways"

Roberts & Porter 1989

"It is impossible to separate selection from training . . . In this country the only case I know of a thoroughly validated selection procedure from first to last was one in which selection and training were treated as a single problem"

Sir Frederick Bartlett 1946

Assessment centres

Candidates are brought together in groups of 4–12, over a period of 1–3 days, and are asked to carry out a series of novel exercises, often involving group work (Roberts & Porter 1989). This is the core approach of the army, civil service and major companies. Assessment centres are particularly appropriate if the emphasis is upon assessing ability under competitive time stress or upon collaborating in group activities. Their reliability is good since assessors are highly trained but they are very time-consuming for staff and applicants and also expensive.

The cost(s) of selection

The direct costs of selection for a medical school are difficult to assess, but are probably between about £500 and £1000 per entrant, mostly accounted for by staff time. The implicit criterion of success is that graduates will practise high-quality medicine in the National Health Service from graduation until retirement, perhaps 40 years later. This contrasts with the £40 000 or so spent by British companies whose criterion of success is that the graduate stays with the company for five years.

There are two reasons why so little is spent on medical student selection. At present student selection is an 'open loop system', without feedback. A bad doctor may cost society very large amounts of money, but none of that cost comes back to the medical school. Selection costs are therefore seen as of little benefit to an institution and the temptation is to minimise them. If life-long medical practice were a closed-loop system, with graduates incurring costs and providing rewards to their medical school throughout their career, then selection and undergraduate training would be at the core of a medical school's activities, instead of being marginalised.

Routine monitoring of selection

Because selection is so vulnerable to criticism and possibly even to legal challenge, it is essential not only

that clear policies are in place, but that routine data are collected for the monitoring of the process. Monitoring should look at the overall pattern of selection, assessing whether particular groups of applicants (women, ethnic minorities, students with disabilities etc.) are being systematically advantaged or disadvantaged. A simple head count is not sufficient for this purpose, since groups may also differ in a range of relevant background factors; multivariate analysis is the appropriate procedure, both for identifying possible disadvantage and understanding its locus (McManus 1998).

Studying selection and learning from research

Medicine can be notoriously insular. Research and experience outside of medicine are often ignored, and there are medical schools which will not even consider experience gained at other medical schools, never mind in industry, commerce and the public sectors in general. Personnel selection has been much studied and there is a vast literature. A good place to start is the regular series of articles in the *Annual Review of Psychology*, which are frequently updated (Borman Hanson & Hedge 1997).

Evidence-based medicine and the scientific study of selection

Evidence-based medicine is the current dogma in all areas of medicine. Student selection and medical education should be no different. The limitations should be recognised. If randomised controlled trials are taken as the only criterion of evidence then the vast majority of medical education would not be valid – with the inevitable result that opinion, prejudice and anecdote end up as the bases for action. Observational studies and the powerful methods of epidemiology are also useful, particularly when embedded in robust theories based in psychology, sociology and other basic sciences. A frequently

encountered error when discussing, say, a prospective study of selection is to use both of the following arguments simultaneously:

- 'These students have only been followed up for 5 years, but our selection process was assessing who would become good practising doctors in the future. These results do not look far enough into the future.'
- 'This study was carried out over 5 years ago, and since then we have changed our selection process and our undergraduate curriculum, and the doctors will be working in a medical system that has also changed. These results are only of historical interest.'

When put like this the sophistry is immediately apparent – prospective, longitudinal studies for N years must, of necessity, have been started more than N years ago. Of course, the same arguments are not used in medical practice – chemotherapeutic regimes looking at 5 year survival must be subject to the same problems, but these trials are still done.

A further problem with studying selection is that it is very vulnerable, as are the egos of the individuals carrying it out. No one likes to think that their actions have been wasted or that their best-considered schemes are worthless. Neither does any institution like to see results published suggesting that it has not been doing a perfect job, particularly when its rivals' results are not publicly displayed. A common reflex response is to demand an unreasonably high criterion of evidence, which is a paragon of perfection. The scientific studying of selection is no different from any other science. One is not searching for proof of absolute truth, but identifying working, explanatory, hypotheses compatible with evidence, which have acceptable methodology, take known problems into account, and are therefore robust against straightforward refutation and make useful predictions. That is then a basis for practical action and further research.

Summary

Selection is an important yet usually under-resourced aspect of medical school activity.

Applicants may select medical schools because of their particular courses or their invitation to attend an interview. Medical schools may select applicants by their intelligence, their learning style and motivation, their ability to communicate and by evidence that they are conscientious.

A variety of methods of selection may be used by schools ranging from a purely administrative review of application form details, through assessment of personal biodata, to psychometric testing of candidates.

Whatever process is used it is likely to be costly and should be routinely monitored, evaluated and compared with examples of best evidence-based practice.

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