

Evaluation of a rule base for decision making in general practice

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SUMMARY

Background. Decision making in general practice relies heavily on judgmental expertise. It should be possible to codify this expertise into rules and principles.

Aim. A study was undertaken to evaluate the effectiveness of rules from a rule base designed to improve students' and trainees' management decisions relating to patients seen in general practice.

Method. The rule base was developed after studying decisions about and management of thousands of patients seen in one general practice over an eight year period. Vignettes were presented to 93 fourth year medical students and 179 general practitioner trainees. They recorded their perception and management of each case before and after being presented with a selection of relevant rules. Participants also commented on their level of agreement with each of the rules provided with the vignettes. A panel of five independent assessors then rated as good, acceptable or poor, the participants' perception and management of each case before and after seeing the rules.

Results. Exposure to a few selected rules of thumb improved the problem perception and management decisions of both undergraduates and trainees. The degree of improvement was not related to previous experience or to the stated level of agreement with the proposed rules. The assessors identified difficulties students and trainees experienced in changing their perceptions and management decisions when the rules suggested options they had not considered.

Conclusion. The rules developed to improve decision making skills in general practice are effective when used with vignettes. The next phase is to transform the rule base into an expert system to train students and doctors to acquire decision making skills. It could also be used to provide decision support when confronted with difficult management decisions in general practice.

Keywords: medical decision making; management of disease; clinical judgement; consultation process.

Introduction

THE general practitioner deals with patients with a wide range of problems, consultation time is limited and there are many social and psychological factors that affect patient management. Medical students learn about decision making in an unstructured way, through observation and by emulating the thought processes perceived to be used by their teachers. Few medical schools provide systematic instruction in decision making skills, and teachers lack effective methods for training doctors to acquire these critical skills.¹

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Several methods of formal reasoning have been proposed to improve the quality of clinical decision making, especially in a diagnostic context. Examples are Bayesian methods² and methods involving expert systems.³⁻¹⁵ Few such methods have been aimed at general practice, and systematic evaluation of their effectiveness has seldom been undertaken.¹⁶

Decision making in general practice relies heavily upon judgmental expertise. This expertise is largely developed by practical experience and its detail will often not be consciously recognized, but it should be possible to codify it into a set of specific rules and principles that are recognizable as being commonly observed. A rule base of this kind has been developed and it is ultimately intended that it should form the basis for an expert system for use in general practice.

A study was therefore undertaken as an essential first stage to determine whether exposure to selected items from the rule base was capable of improving the decision making skills of medical students and general practitioner trainees. The appropriateness or otherwise of participants' responses was judged by a panel of expert assessors.

Method

Rule base

The 'rules of thumb' were generated by B E during general practice consultations over an eight year period, 1983-91. Information recorded after each consultation included the presenting problem, relevant observations, actions taken, and factors affecting management. A large number of rules were distilled from these records. For example, if a diabetic patient was found to have a raised blood glucose level, compliance was checked before increasing medication. Compliance thus affected management and such cases generated the rule 'assess compliance before changing treatment or evaluating outcomes or effectiveness.' A total of 700 rules were generated, most of which were general though some were disease specific.¹⁷

Vignettes

A large number of vignettes based on real cases were selected for the study covering a range of problems relating to prevention, diagnosis, investigation, management, follow up, evaluation and prevention of recurrence. They included ethical dilemmas, organizational and administrative problems, and mistakes as well as problems relating to specific conditions such as the human immunodeficiency virus (HIV) infection, mental illness, psychological and social problems, and chronic diseases. Each vignette had between one and seven items from the rule base judged by B E and the assessors to be particularly relevant to that problem. Three of the vignettes and the corresponding rules are given in Appendix 1.

Participants

The participants comprised fourth year clinical students at the Royal Free medical school and general practitioner trainees in vocational training programmes in the south east Thames region and in training for general practice in the Royal Army Medical Corps. During special sessions participants were each given four vignettes and were asked to describe their perception (by being asked 'How do you see this problem?') and proposed manage-

ment of the problems involved, They were then given the rules selected for each case and asked what changes, if any, exposure to the rules had made to their perception and management. They were also invited to state for each rule whether they disagreed with it, agreed and had already taken it into account, or agreed and had changed their perception or management accordingly.

Assessors

Participants' responses were judged by a panel of five assessors, chosen to cover a range of medical opinion. All were experienced professionals whose backgrounds included general practice, teaching, and training of trainees, undergraduates, nurses and other members of the primary care team. One of the assessors was a lecturer in an academic department of general practice. All the assessors studied the rules for each case and agreed that these were appropriate and relevant.

The assessors independently rated participants' perception and management of each vignette both before and after exposure to the rules on a scale of two for good, one for acceptable, and 0 for poor. Each participant thus received four scores (perception and management, before and after exposure) from each of the assessors for each vignette. Four overall scores (ranging from 0 to 40) were obtained by summing the five assessors' scores for each of the four vignettes reported on by the participant. Changes in trainees' scores were examined in relation to medical education and work experience.

Participants' agreement ratings were scored -1 for disagreement, 0 for agreement with no change and 1 for agreement with change. An overall agreement score for each participant was calculated by first calculating the mean over the 1-7 rules for each of the participants' four vignettes, and then taking the mean of these four values.

Scores were analysed using the student *t* test and correlation coefficients.

A sample of the trainees were presented with some more vignettes a few weeks later. The rules relevant to these vignettes were the same as the original rules. The aim was to examine whether the relevant rules could be recalled.

Assessors were also asked for their general comments regarding participants' perception and management plans for vignettes.

Results

Reports from all 93 medical students and 179 of the 191 general practitioner trainees were included in the study (12 reports were incomplete or illegible).

Participants' scores for both perception and management varied widely, from six to 40. Trainees' scores tended to be higher than those of the medical students, though there was considerable overlap. The mean scores before and after participants were

shown the relevant rules are given in Table 1. The mean changes were all highly statistically significant, showing that exposure to the rules had been beneficial for the majority of participants.

The percentage of participants who showed an increase of two or more points overall is also given. The mean change in mean score for management was greater than for perception. There was no evidence that levels of change differed between students and the trainees.

The changes in mean scores for perception and management were correlated for both the students ($r = 0.66, P < 0.01$) and the trainees ($r = 0.55, P < 0.01$). These correlation coefficients were increased to 0.78 and 0.67 when allowance was made for the level of agreement between the five assessors. Thus, for example, a participant showing a large increase in perception score was likely also to show a large increase in management score.

The relation between the changes in scores and the agreement scores was studied on a subset of the trainees: for both perception and management the correlations were near to zero.

Changes in trainees' scores were studied in relation to whether the subjects had trained abroad, had had fewer than three months' general practice experience or had held pre-registration hospital posts only. In all cases the difference in increase amounted to no more than approximately one standard error, below statistical significance.

Thirty trainees were presented with some more vignettes eight weeks later. All of the trainees were able to recall the relevant rules, though no suggestion had been made that the rules should be memorized.

Comments by assessors highlighted some issues. Participants often disagreed with rules relating to ethical issues which the assessors felt were relevant. Many ethical dilemmas concerning, for example, confidentiality, informed consent and patients' rights were not perceived as such. There was a reluctance among participants to seek advice about problems which were not within the general practitioner's expertise. Many participants did not remember opportunistic prevention and prevention of recurrence as part of general management. Relevant social and cultural factors were often not taken into consideration by participants, even when they were referred to in the rules. There was often a failure to make a differential diagnosis when this was critical for optimal management. Perceptions of urgency were low compared with those of the assessors.

Discussion

The rule base was found to be effective in improving students' and trainees' perception and management of vignettes. It was not clear why some participants improved more than others but it did not seem to be related to measurable experience. The correlation between improvements in perception and management suggests a

Table 1. Medical students' and trainees' mean perception and management scores before and after presentation with the appropriate rules.

	Mean score ^a		Change in score		% of participants increasing score by 2+ points
	Before seeing rules	After seeing rules	Mean (SE)	Range	
<i>Trainees (n = 179)</i>					
Perception	22.9	26.7	+3.8 (0.3)***	-3 to +22	58
Management	22.2	27.7	+5.5 (0.3)***	-6 to +21	81
<i>Students (n = 93)</i>					
Perception	16.3	20.3	+4.0 (0.4)***	-1 to +13	63
Management	16.8	21.9	+5.1 (0.4)***	-2 to +15	76

n = number of participants in group. SE = standard error. ^aMaximum score = 40. Student *t* test: *** $P < 0.001$.

'receptivity' factor, distinct from participants' stated level of agreement with the rules. In fact, the assessors found that some participants claimed that agreement with a rule had changed their management when there was little evidence of this, and conversely that participants disagreeing with a rule often changed their management after seeing the rule.

The later study, in which it was found that trainees recalled the rules, suggests that the rules had been internalized and had become part of the participants' conceptual framework. The limitations of vignettes are recognized¹⁸ and further studies need to be done to see if relevant rules are recalled when confronted with real patients.

The present study has shown that exposure to a few selected rules of thumb can improve the decision making competence of both undergraduates and trainees. The next phase of the research will aim to develop a computerized search facility that will allow users to identify for themselves the small sets out of 700 rules which are relevant to a particular patient. It is intended to do this by incorporating the rule base into an expert system involving the use of computer technology and a sophisticated programme for conducting appropriate searches. The technology will also facilitate the maintenance and updating of the rule base and will permit the construction of more specialized bases for topics such as mental illness and chronic diseases. Ultimately, it is envisaged that this type of decision support may become a standard feature for training students and trainees to develop decision making skills in general practice.

Appendix 1. Examples of three vignettes presented to participants, and the corresponding rules.

A woman aged 50 years has had diabetes for 18 months. She is normally well controlled on diet and chlorpropamide. A recent blood glucose level measurement was 25 mmol l⁻¹. She feels well and has not lost weight. What is your management plan?

- A differential diagnosis must be made of treatment failure which includes factors related to diagnosis, natural history, presence of complications, patient's behaviour, information given, treatment, dosage, compliance, prevention of recurrence, co-existing diseases and their treatment, and follow up provided.
- Assess compliance before changing treatment or evaluating outcomes or effectiveness.

A boy aged 12 years was visited by a deputizing doctor at 01.00 hours on Saturday. The parents were given a note which is brought into the surgery by the father. It states that the boy has epididymo-orchitis and that he was given amoxicillin and co-proxamol. The father says the boy is more comfortable now. There is no request for a visit. What is your management plan?

- Follow-up visit is indicated if deputizing doctor's diagnosis could have included a potentially serious condition.
- The differential diagnosis must always include conditions which may need surgical assessment.
- Management of night visits generally by deputizing service must be reviewed to decide if urgent follow up is needed.
- The decision to follow up or evaluate the management outcome should be made by the doctor and not the patient.
- If there is no obvious cause for swelling and pain in the testicle, admit to exclude torsion.

A woman aged 49 years who weighs 20 stone was sent to the hospital casualty department because she had fallen. She requests a home visit four days later for a certificate. She says she has a fracture, and the whole leg, from hip to ankle, is in plaster. She has no pain. What is your management plan?

- Prediction of risk of serious problems must always be followed by appropriate management to ensure their prevention or early identification.
- An important management objective is to identify patients who are at risk of developing a deep vein thrombosis, and take appropriate preventive action, such as giving a low dose of heparin.

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