

Linking assessment to learning: a new route to quality assurance in medical practice

R S Handfield-Jones,¹ K V Mann,² M E Challis,³ S O Hobma,⁴ D J Klass,⁵ I C McManus,⁶ N S Paget,⁷ I J Parboosinh,⁸ W B Wade⁹ & T J Wilkinson¹⁰

Background If continuing professional development is to work and be sensible, an understanding of clinical practice is needed, based on the daily experiences of doctors within the multiple factors that determine the nature and quality of practice. Moreover, there must be a way to link performance and assessment to ensure that ongoing learning and continuing competence are, in reality, connected. Current understanding of learning no longer holds that a doctor enters practice thoroughly trained with a lifetime's storehouse of knowledge. Rather a doctor's ongoing learning is a 'journey' across a practice lifetime, which involves the doctor as a person, interacting with their patients, other health professionals and the larger societal and community issues.

Objectives In this paper, we describe a model of learning and practice that proposes how change occurs, and how assessment links practice performance and learning. We describe how doctors define desired performance, compare actual with desired perform-

ance, define educational need and initiate educational action.

Method To illustrate the model, we describe how doctor performance varies over time for any one condition, and across conditions. We discuss how doctors perceive and respond to these variations in their performance. The model is also used to illustrate different formative and summative approaches to assessment, and to highlight the aspects of performance these can assess.

Conclusions We conclude by exploring the implications of this model for integrated medical services, highlighting the actions and directions that would be required of doctors, medical and professional organisations, universities and other continuing education providers, credentialling bodies and governments.

Keywords Clinical competence/*standards; physicians, family/*standards; education, medical, continuing/*standards; quality of health care/standards; *learning.

Medical Education 2002;36:949–958

Introduction

A well-known photograph of Sir William Osler shows him in characteristic pose at his desk, surrounded by a

¹Department of Continuing Medical Education, College of Family Physicians of Canada, Mississauga, Ontario, Canada, ²Division of Medical Education, Dalhousie University, Halifax, Nova Scotia, Canada, ³Ufi Ltd, Sheffield, UK, ⁴Department of General Practice, Centre for Quality of Care Research, University of Maastricht, Netherlands, ⁵Quality Management Division, College of Physicians and Surgeons of Ontario, Toronto, Canada, ⁶Department of Medical Education, University College, London, UK, ⁷Department of Medicine and Psychological Medicine, Monash University, Melbourne, Victoria, Australia, ⁸Royal College of Physicians and Surgeons of Canada, Canmore, Alberta, Canada, ⁹Education Department, Royal College of Physicians, London, UK, ¹⁰Christchurch School of Medicine and Health Sciences, Christchurch, New Zealand

Correspondence: Dr R Handfield-Jones, Continuing Medical Education, College of Family Physicians of Canada, 2630 Skymark Ave., Mississauga, Ontario, Canada. Tel.: 00 1 905-629-0900; Fax: 00 1 905-629-0893; E-mail: rhj@cfpc.ca

pile of books and papers – the paragon of medical virtue attending to his continuing medical education.¹ We know from the clinical method he espoused that Osler learned from his practice as well. Despite his example of making his practice his springboard for learning, medical educators have long focused on formal undergraduate and postgraduate education programmes as the principal targets of their energy. It is noteworthy that it is only at these early stages of medical education that examinations, the hallmark of gravity of educational purpose, are imposed. Until recently, practising doctors have resisted the idea of ongoing practice assessments, possibly because of negative associations with such examinations. Nonetheless, the positive, and (some would say) necessary, role of assessment in learning needs to be embraced as a driving force of continuing professional development in promoting continuing competence.

If such development is to be useful and reasonable, we need a model describing clinical practice that is

Key learning points

- Physician performance varies over time, both among and within patient conditions.
- Assessment of performance and learning must be linked effectively to improve practice.
- Doctors differ in how they monitor and detect variations in their performance, and in how they respond to these variations.
- Different assessment methods may capture different aspects of practice.
- Individual, professional and system-wide changes are needed to incorporate a quality assurance approach to linking learning and assessment.

representative of the daily experiences of doctors within large-scale social and political contexts. The model must also accommodate differences among individual doctors in the nature of the learning process in actual practice, as well as accounting for differences among various approaches to practice assessment.

We propose such a descriptive model of practice. Like all models, it will over-simplify, but that is intended, as a complex model provides no advantages over looking at the real world itself. Its intent is to place assessment, both formal and informal, at the centre of a cycle of learning for individual doctors. The anticipated outcome of this cycle is accommodation to change and improvement in practice that follows an educational plan. This improvement in practice applies not just to individuals, but also to the overall system.

In presenting our model, we will begin with our proposal for a new paradigm for medical practice, one that more closely reflects current understandings. Our model attempts to link practice performance and learning; we will use it as a means of describing how doctors' performances may vary and how they may respond. From there, we will introduce ways in which

various forms of assessment may interact with and perceive doctor practice. Lastly, we will explore how such a new approach to practice assessment might be incorporated, and the kinds of actions and direction that will be required.

Old and new practice paradigms: from rockets to hiking

Conventional wisdom has suggested that doctors begin their practices so thoroughly trained and so well inclined by character to continue learning that their patients could reasonably expect them to remain competent throughout a lifetime of practice. This perspective, as described by the late J P Gemmell, MD, is the 'ballistic' model of competence in which a doctor is *launched* into practice [personal communication]. The *trajectory* of the average doctor rises rapidly above the required level of competence at the beginning of practice, peaks at some time in mid-career, begins to decline as time passes, and eventually slips gracefully below a safe level just as retirement age is reached (Fig. 1).

While acknowledging the simplicity of this model, critical analysis demands its rejection. The rocket ship of a medical career is not launched into a vacuum. Practice is no longer characterised in terms that relate to pure science. It involves the challenges of uncertainty and complexity, well described by Schön,² and recognized intuitively by all practitioners.

The process of practice begins with the interaction between doctor and patients. But, although a medical career involves innumerable patient encounters, it is ultimately practised one patient at a time [A Laduca, personal communication]. By attempting to characterise either the 'competence' or 'performance profile' of individual doctors, it soon becomes clear how situation-specific their abilities really are.³

Any attempt to describe the nature of continuing practice must include doctors' individual characteristics and a thorough understanding of the changing environment of their practice 'journeys'. This includes many factors at increasing levels of organisational

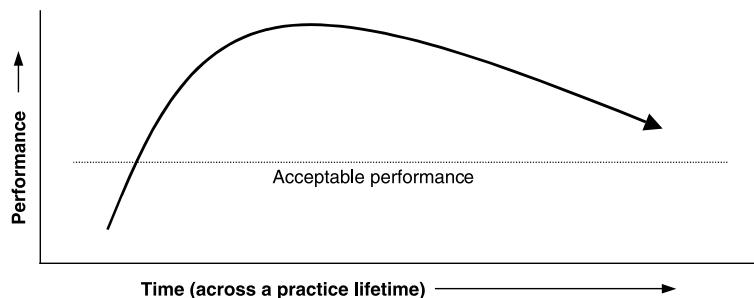


Figure 1 The 'trajectory' model of competence.

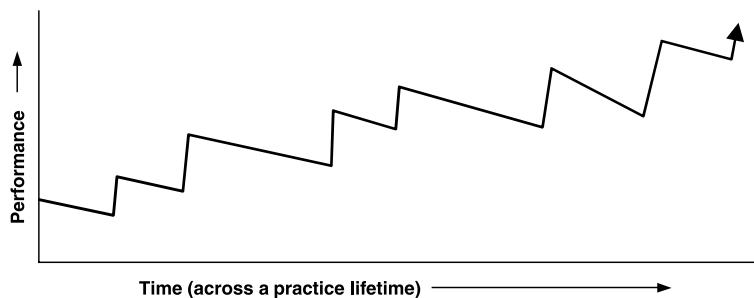


Figure 2 The 'on-the-ground voyage' model of competence.

complexity: autonomous patients with their individual needs; families, practice contexts and settings; other health care workers; medical and regulatory organizations; and broader social and community issues. Schön's description of this complicated environment as a 'swamp' captures the flavour of the problems practitioners face.²

There are also two phenomena inherent in performance and learning, but independent of the practice and context particulars. Firstly, there is a version of entropy in performance: unless something influences it, practice tends to get worse over time. This has at least two causes. Medicine itself is continually advancing, and so an unchanging practitioner will inevitably be left behind. In addition, the maintenance of a high level of performance at highly complex and uncertain tasks requires feedback, the absence of which will inevitably lead to deterioration in performance.

Secondly, change generally occurs in jumps. Improvement in cognitively low level skills, such as those involved in motor activities, can occur continuously on a trial-by-trial basis. But this does not characterize the learning of high level, cognitively complex tasks, which typify much of clinical practice. Instead, change in medical practice is characterised by periods of time where there is either no improvement or a slight decrease in performance followed by sudden incremental improvements.^{4,5} There are important reasons for this. Cognitive learning often involves seeing a problem from a new perspective or viewpoint. Change requires cognitive re-organisation and perhaps even the abandonment of previously learned principles or approaches. This kind of change cannot be gradual. Moreover, all change requires mental effort. As we have a finite amount of cognitive resources, it is impossible to monitor and change continually the complex mixture of skills, knowledge and behaviour required by professionals. So, at any one time, performance deteriorates in some tasks while it improves in others.

As a result of all these factors, medical practice becomes more like a jagged voyage along an ever-

changing and sometimes hazardous earthbound path, rather than a smooth ride through pristine space. The rocket becomes a hiker, struggling up a rugged mountain with its natural ups and downs (Fig. 2).

Practice maps and learning

The shift in model from a trajectory in space to a voyage on the ground implies that doctors continuously learn and change in daily practice. This learning in practice differs from learning during medical training. Simply stated, undergraduate students learn core medical competencies, which are often extended to optional topics on the basis of theory. Postgraduate students learn the core competencies in their specialties. But practising doctors must keep up with advances in their fields and learn in the context of problems arising in daily practice.

The approach to planning ongoing learning can occur in several ways. Traditionally, practitioners might review the content areas of their practice over a defined time period, such as 10 years. However, this does not necessarily address the specific and various needs of individual practitioners, their variations in learning styles, patient populations and career stages, or the effects of specific interests or previous learning experiences.

The planning of learning activities that would respond to these variables over time would be easier if there were a 'practice map' available. This could indicate an identifiable route including a starting point, the terrain, key landmarks along the way, and an ideal practice destination. It would help maintain the direction of learning by representing a personal plan identified by key objectives within a timescale. It could also signify how objectives are to be achieved by understanding the practice community and by building on the attitudes, skills and knowledge which form the basis of the doctor's current practice.⁶

This concept of a practice-based educational map is driven more by the experience and needs of the doctor (and the practice) than by theory.⁷ A major

consequence of this is the recognition that individualized, practice-based educational programmes should be defined so that doctors' educational efforts can be maximised according to the relevant aspects of their own practices. Ultimately, a generalised practice map would become the centrepiece of a rational and educationally based process of professional regulation, provided it can be incorporated appropriately into an integrated quality improvement programme.

In this new paradigm, doctors' learning is a process to be managed throughout a complex journey. The doctor takes a dynamic approach, not only in treating patients and in working with colleagues, but also in initiating and enhancing the learning process. Developing a system for learning that arises from needs in daily practice and that involves the individual doctor is part of the challenge in meeting the public's expectations of its health care system.

Assessment links practice performance and learning

A systematic approach to the practice-generated identification of learning needs is essential for doctors to manage their ongoing professional development.^{8,9} Figure 3 is a graphic representation of this approach.

Assessment occurs when a doctor compares the characteristics of actual practice to some ideal or desired practice. Doctors must gather valid and reliable information about their approach to problem management and their patients' health outcomes in order to understand the appropriateness and adequacy of

their performance. This should involve the identification of important facilitators and barriers to learning and incorporation of new information into practice.

Desired practice can be defined in different ways, such as through an understanding of others' practices, clinical practice guidelines or standards, other relevant professional benchmarks, and the specific demands of patients and the public. To as great an extent as possible, it should be evidence-based. The assessment process itself can also inform the definition of desired practice as it evolves.

Assessment should be principally formative in order to provide doctors with information on how they are doing and with feedback about the effectiveness of quality improvement activities, thereby enhancing the quality of the learning process itself. Summative assessment is undertaken when a destination has been agreed upon, and is interdependent with all the other stages of the journey, including any intermediate formative assessments.

Assessment can *validate* and reinforce those aspects of actual practice that are seen to be consistent with desired practice. Where a discrepancy is found, the doctor must further analyse and consider whether modifying that current practice is required. *Contemplation* or reflection on practice helps to understand the difference, its causes and its implications. From this process, an *educational need* may be defined. *Educational action* is the desirable outcome of the assessment process whenever a discrepancy in practice performance is identified. The literature on change in doctors' behaviour describes how the size of the gap between actual and desired practice influences personal motivation and learning.¹⁰ A small discrepancy may be overlooked; however, a large one may appear unrealistic and thus be denied. For effective learning to proceed, achievement of the desired outcome must be perceived either as realistic or as divisible into manageable learning steps, and as transformable into a learning plan.

The potential *rewards* for participating in a range of educational activities will be largely intrinsic initially. They include the satisfaction of acquiring new knowledge and skills, and the increased confidence that comes with achieving consistency with peers and accepted best practice. The positive practice change that results is a strong motivation for this approach – it helps to encourage further reflection and leads to the planning of the next stage of the journey. The continued positive reinforcement resulting from this ongoing and iterative assessment process is consistent with how quality improvement cycles could be viewed and implemented.

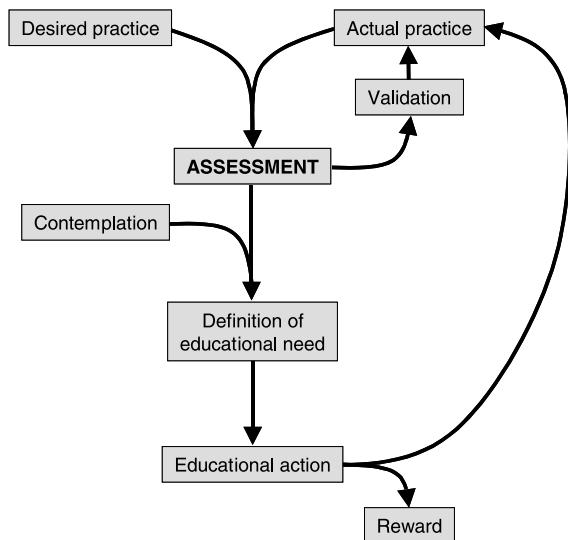


Figure 3 Assessment as a comparison between desired and actual practice.

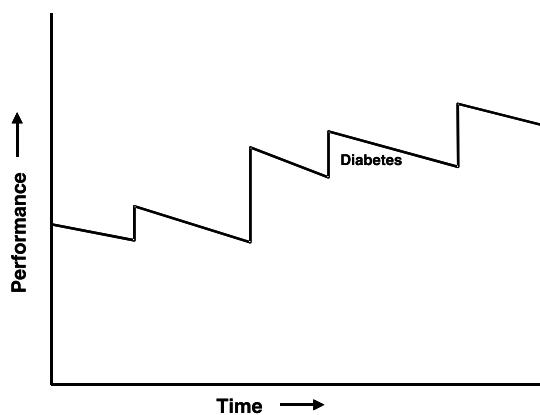


Figure 4 Performance on managing a single condition.

How does this model work?

We illustrate how understanding and assessing practice over time can be applied to actual medical practice and ongoing competence. Figure 4 illustrates a doctor's performance in managing a single condition, in this example, diabetes. The jagged line represents the range of performance by a typical, competent doctor. The performance of groups of doctors or the profession would be the aggregate of many such graphs. Over time, performance gradually improves through sudden upward jumps at irregular intervals within a series of gradual declines.

There are many causes of such jumps, but the usual and most immediate one is that the doctor becomes aware of a discrepancy between their actual performance and their desired performance. This perceived fall of their practice performance below their 'minimum personal acceptable level' leads to some action for improvement (Fig. 5). This has been called an 'Aha!' experience, a 'surprise', a thought-provoking incident,

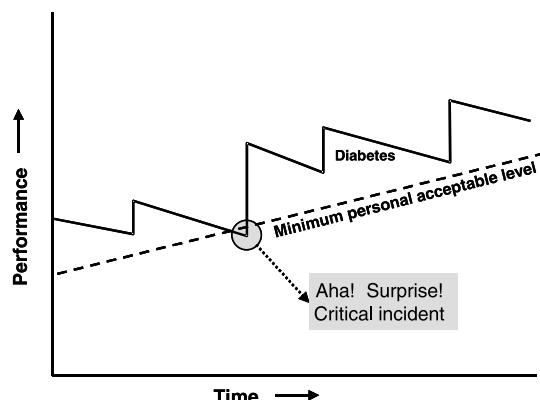


Figure 5 Performance falling below the minimum personally acceptable level.

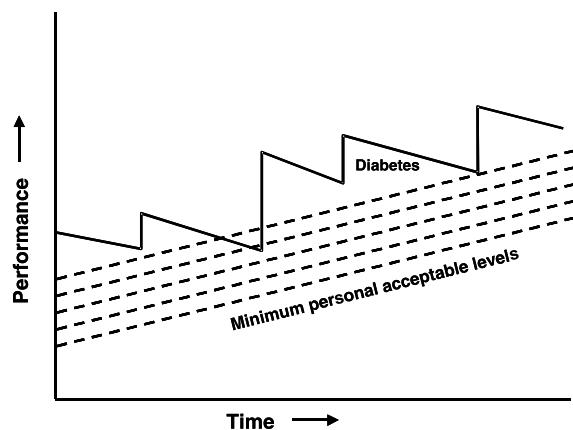


Figure 6 Differing minimum personally acceptable levels of different doctors.

and a 'critical incident'.^{2,11,12} Critical incidents might include occasions where errors have either occurred or been narrowly averted.

But managing practice exclusively by avoiding the minimum acceptable standard amounts to crisis management and is usually avoided by skilled doctors. Jumps in performance occur because other acceptability lines have been crossed. 'That wasn't very good' or 'Am I missing something?' are less dramatic sentiments that can also lead to change.

Doctors differ in the level at which they perceive a problem and take action. The same objective level of performance may trigger action in some doctors but not in others (Fig. 6). The reasons for such differences in 'minimum personal acceptable levels' may include doctors' personalities, knowledge, attitudes and experiences, the effects of co-workers, and the influence of professional guidelines and standards.

With no improvement, performance may continue on a downward course to the point where another line, the 'minimum professionally acceptable level', is crossed (Fig. 7).

If the 'minimum personally acceptable level' is above (Fig. 7, at line a) the 'minimum professionally acceptable level', the doctor may have insight into the problem despite failing to institute any corrective measures. On the other hand, if it is below (Fig. 7, at line b) the 'minimum professionally acceptable level', the doctor may be unaware there is a problem. Here, a practice might warrant further scrutiny by a regulatory body, and appropriate action by that body might be required.

A confounding factor is the accuracy of doctor perceptions. Some doctors may overestimate or underestimate their actual performance level (Fig. 8). Unless there are other interventions, it is self-perceived

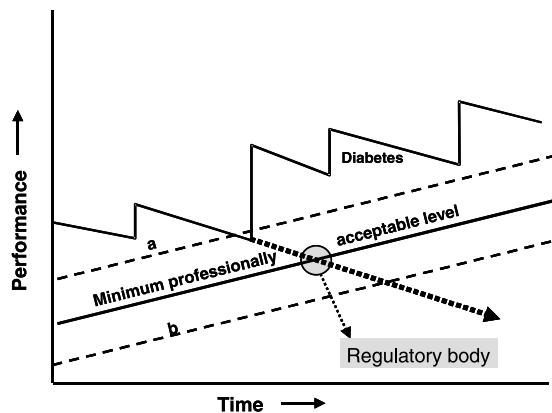


Figure 7 Performance falling below the minimum professionally acceptable level.

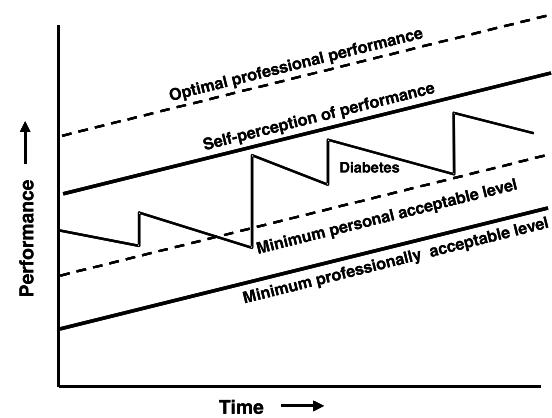


Figure 8 Differing self-perceptions of performance.

performance rather than actual performance that will trigger action.

These graphs of performance are actually composites of many individual practice episodes (Fig. 9). With increased resolution, performance can be seen to vary from encounter to encounter because of the various effects of different patient and practice circumstances.

Many adverse outcomes happen when there is a coexistence of multiple circumstances, none of which would be causative individually. When a doctor's performance is slowly declining, minor fluctuations can push performance below either the minimum personal acceptable level or even the minimum professionally acceptable level. These events can have a dramatic psychological effect. It can seem that performance has suddenly declined when it is really a symptom of an overall gradual decline.

There is an interesting corollary to this process. After performance has risen as a result of a jump, a

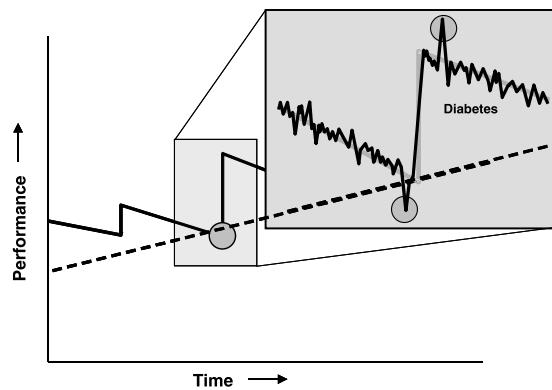


Figure 9 Performance across individual practice encounters or episodes.

particularly well-handled case can be very satisfying; we call these 'champagne moments'. These can reinforce and validate learning that has recently occurred.

We have discussed the performance pattern for a single condition. In practice, a doctor handles a range of clinical problems and situations, each of which has its own pattern (Fig. 10).

Notice that the jumps and declines are not simultaneous across the different conditions. In fact, there may be negative correlations if improving one task detracts from the efforts needed to improve others. This is a further justification for professional education being continual, so that educational events can be responsive to and embedded in daily professional practice.

Where does assessment fit?

Using our model of learning in practice, and our conceptualization of how performance varies across and within practices, we will illustrate different types of

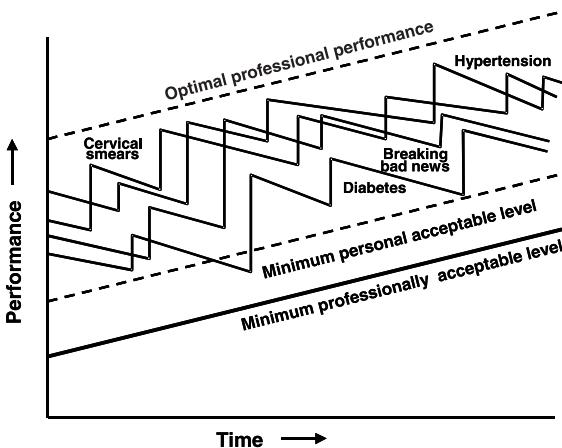


Figure 10 Performance across different conditions.

assessment and how each might apply. Our purpose here is to illustrate the different insights into practice that each might provide.

Self-assessment has already been illustrated. As part of a continuous process, doctors will occasionally perceive that they have crossed one of their own personal performance levels, and action may be initiated. The effects of such educational interventions can be monitored precisely and immediately. A weakness of this process is that self-perception of performance or the decision of what action to be taken may be inaccurate.

Periodic summative assessments, such as examinations, take a snapshot of performance at a single instant in time. Performance is assessed for a range of problems across a targeted clinical domain and a composite or average score is calculated (Fig. 11).

A weakness of such summative assessments is that the average scores may fail to account for variation in performance across activities unless sampling is extensive. An overall satisfactory score may distract a doctor from examining the variations in their performance and, possibly, obscure particular weaknesses. Providing detailed feedback could circumvent this effect, but this may appear to be unreliable and some assessment bodies are concerned that it could compromise confidentiality of assessment materials. Another weakness of this method lies in the fact that, if assessment occurs infrequently, performance on individual tasks may deteriorate without notice.

Practice audits, in contrast, collect detailed data on the management of a single condition or small group of conditions over a longer period of time (Fig. 12).

Because audit data are collected after the events have occurred, linking the subsequent educational interventions to the daily life of practice can be

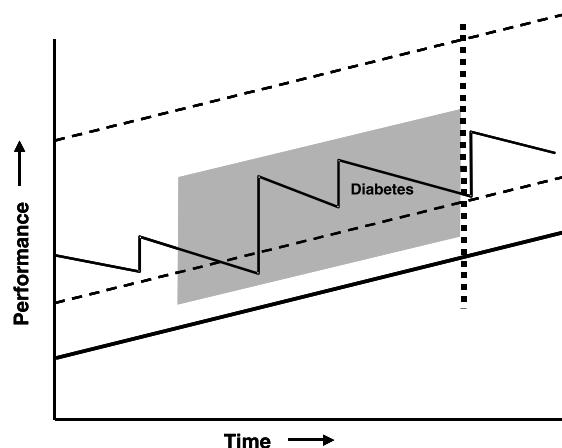


Figure 12 Assessment using a practice audit.

difficult. Audits also tend to emphasize those activities that can be measured easily; some important activities may not be amenable to audits. Audits are also limited in their ability to represent a doctor's overall performance.

Auditing according to practice profiles looks at more conditions over a shorter period of time, albeit superficially (Fig. 13).

Practice profiles may be less representative, but they can consider the totality of performance across all important conditions within a doctor's daily practice challenges.

Formative assessment can take many forms, but often involves more limited assessments at more frequent intervals (Fig. 14), with provision of feedback.

In Fig. 14, the arrows represent times at which such formative assessments occur. The two circled arrows indicate assessments before and after a jump in

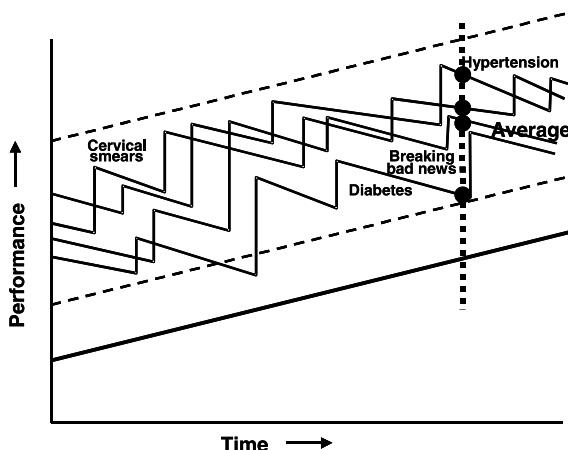


Figure 11 Summative assessment.

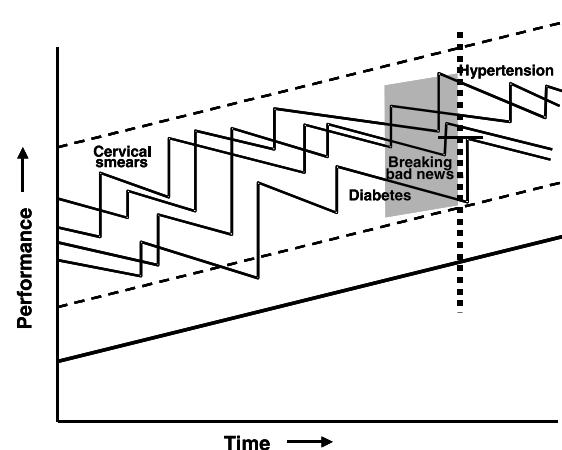


Figure 13 Assessment using a practice profile.

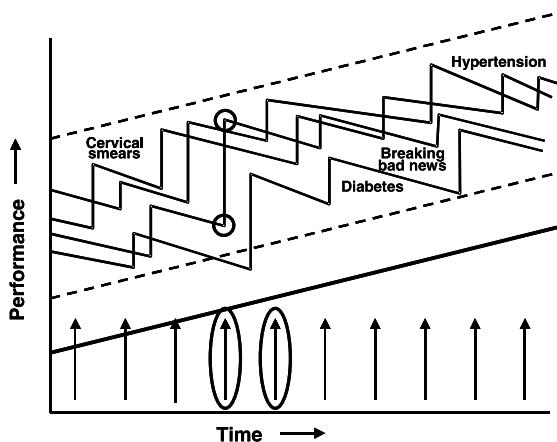


Figure 14 Formative assessment.

performance in one task. The first one helped to identify a developing weakness needing intervention. The second assessment helped to encourage critical reflection on the changed level of performance, and to reinforce such good practice.

In considering these different types of assessment, our model illustrates how each will gather different information about practice. Clearly, in terms of our model's assumptions, more frequent assessments offer opportunities for correction and maintaining practice above the level of minimally acceptable performance. Assessments must take care to go beneath the summative levels, to look at individual practice domains. Ultimately, a combination of methods will best support doctors in continually monitoring and improving performance.

Making new approaches a reality: who should be involved

For any new approach to practice-based assessment and learning to have an impact, it must be workable and have the support and co-operation of all involved. We need to understand how each constituency would define and adapt to new roles. How could such a model, based on some theoretical constructs, be tested and ultimately adopted by doctors, educational bodies, regulatory agencies and health care institutions?

Perhaps the principal challenge in this new paradigm is for doctors themselves to come to accept the concept of a need for continuous improvement, and to be prepared to adopt the processes needed to support this kind of activity. This will require a significant, but not insurmountable, shift in attitude. Practice-based reflection and learning approaches are increasingly promoted

by continuing education providers, as well as in undergraduate and graduate medical education.^{13–15} The concept will become less threatening as regulatory bodies demonstrate that the results of practice assessments can, in practice, be used positively and confidentially. Evidence that this is possible is already available.¹⁶

Medical practices will have to be organized to collect and analyse practice and outcome data. Ultimately, this will require a much greater use of information systems, especially computerized medical records.¹⁷ Before adequate systems are widely available, other longstanding techniques can be utilized. Surgeons have used 'morbidity and mortality rounds' to critically assess how their practices compare with others, and how experience can be used to improve practice. Paper-based chart audit exercises can also generate valuable information.

Medical associations and professional colleges have an important leadership role to play. They can act as forums for members to discuss new approaches to their practices. As a conduit for collective opinion, regional and national organizations should be influencing policymakers to ensure that policy decisions are realistic and congruent with evolving doctor attitudes and beliefs.

Organizations involved in negotiating doctor benefits, fees and conditions of practice should lobby governments and other payers to acknowledge the worth of this approach to the effective management of clinical practice. Universities and other continuing education providers will need to incorporate more input from participating doctors as they come to understand their practices better, and from organizations charged with defining and promoting practice standards.

Credentialling bodies have perhaps the most important role to play in the adoption of these new ideas. In many countries, ground-breaking programmes of doctor performance assessment are being developed, and doctors are starting to realize that they will be subject to regular practice scrutiny.¹⁸ At the most basic level, this could occur as a straightforward summative assessment with a simple declaration of 'adequate' or 'inadequate' practice with some action prescribed for the latter.

Most credentialling bodies are building a formative component into the process, conveying the strong message that this is for the benefit of doctors and their patients.¹⁹ Actions are intended to be educational in nature, even for fairly major deviations from the defined practice standard. Determining the cost-effectiveness of an assessment intervention is an issue that will require ongoing evaluation.

Governments have a fundamental interest in the quality of practice provided by the doctors in their jurisdictions. If practice-integrated assessment and learning are effective ways of ensuring good quality practice, then governments should support the kinds of interventions that will be required. Resources must be directed to the development, installation and maintenance of effective information systems and infrastructure. New approaches to doctor benefits and remuneration should incorporate greater emphasis on integrated quality assurance activities.

Conclusions

We believe that patients have the right to expect that doctors, as members of a learned profession, can demonstrate that they practise effectively and in a manner which pays heed to contemporary theory and policy. We believe that meeting this expectation assumes that doctors base their ongoing education upon issues that arise naturally in practice. These educational needs must be recognized and met in the context of individual practices, yet they must be defined in reference to broadly defined standards of health care delivery.

An important issue that emerges from our interpretation relates to the determinants of this ongoing process of learning. Assessment is fundamental to improving practice.¹¹ As a profession, medicine needs to restore the notion of the 'doctor scientist'. By this, we do not mean the medical researcher who happens also to see patients. Rather, we believe that all doctors should see their encounters with patients as moments of questioning and opportunities for learning.

Meaningful assessment begins with curiosity and critical reflection, and proceeds through multiple voyages of learning that should be well planned and supported by the best available evidence. Any legislated assessment system must acknowledge the nature and value of these voyages. In fact, many different organizations and constituencies will need to cooperate in the development of the systems, attitudes, expertise and resources required to make this happen.

Professional self-regulation, which stresses autonomy and accountability, can best be accomplished in an affirmative educational framework, as proposed here, as opposed to a punitive and legalistic one. Enclosing the simple cycle of assessment, targeted education and reassessment within a framework that values quality of care above all else seems the best route for the profession to take to meet the expectations of our patients.

Contributors

All authors contributed equally to the discussions at the 10th Cambridge Conference that led to the writing of this article. RH-J took main responsibility for preparing the draft, co-ordinating input from the other authors and editing the final version of the paper.

Acknowledgements

Grateful acknowledgement is made to the sponsors of the 10th Cambridge Conference: the Medical Council of Canada, the Smith & Nephew Foundation, the American Board of Internal Medicine, the National Board of Medical Examiners and the Royal College of Doctors.

References

- 1 Bliss M. *William Osler; a Life in Medicine*. Oxford; New York: Oxford University Press; 1999.
- 2 Schön DA. *The Reflective Practitioner*. New York: Basic Books; 1983.
- 3 Elstein AS, Shulman LS, Sprafka SA. *Medical Problem Solving: an Analysis of Clinical Reasoning*. Cambridge, Massachusetts: Harvard University Press; 1978.
- 4 Allard F, Starkes JL. Motor-skill experts in sports, dance and other domains. In: Ericsson, KA, Smith, J, eds. *Towards a General Theory of Expertise: Prospects and Limits*. Cambridge: Cambridge University Press; 1991;126–52.
- 5 Johnson P. The acquisition of skill. In: Smyth, MM, Wing, AM, eds. *The Psychology of Human Movement*. London: Academic Press; 1984;215–40.
- 6 Challis M. Personal learning plans. *Med Teacher* 2000;22:225–36.
- 7 Laduca A. Validation of professional licensure examinations. *Evaluation Health Professions* 1994;17:178–97.
- 8 Gordon MJ. A review of the validity and accuracy of self-assessments in health professions training. *Acad Med* 1991;66:762–9.
- 9 Tracey JM, Arroll B, Richmond DE, Barham PM. The validity of general practitioners' self assessment of knowledge: cross-sectional study. *BMJ* 1997;315:1426–8.
- 10 Fox RD, Bennett NL. Continuing medical education: learning and change: implications for continuing medical education. *BMJ* 1998;316:466–8.
- 11 Dewey J. *How We Think*. Mineola, New York: Dover; 1997.
- 12 Flanagan JC. The critical incident technique. *Psycho Bull* 1954;51:327–58.
- 13 Premi J, Shannon S, Harwick K, Lamb S, Wakefield J, Williams J. Practice-based small-group learning CME. *Acad Med* 1994;69:800–2.
- 14 Smits PB, Verbeek JH, de Buissoné CD. Problem-based learning in continuing medical education: a review of controlled evaluation studies. *BMJ* 2002;324:153–6.

- 15 Parboosingh J. Tools to assist physicians to manage their information needs. In: Bruce, CS, Candy, PC, eds. *Information Literacy Around the World. Advances in Programs and Research*. Wagga Wagga, New South Wales, Australia: Charles Stuart University Centre for Information Studies; 2000;121–36.
- 16 Norton PG, Dunn EV, Beckett E, Faulkner D. Long term follow-up in the Peer Assessment Program for non-specialist physicians in Ontario, Canada. *J Quality Improvement* 1998;24:334–41.
- 17 Bernstein RM. Avoiding the mismeasurement of medicine, and improving care. *CMAJ* 1997;157:1549–51.
- 18 Page GG, Bates J, Dyer SM, Vincent DR, Bordage G, Jacques A et al. Physician-assessment and physician-enhancement programs in Canada. *CMAJ* 1995;153:1723–8.
- 19 Kaigas T. Monitoring and enhancement of physician performance (MEPP) – a national initiative: Part III. *Members' Dialogue (CPSO)* 1996;4:21–4.

Received 21 March 2002; editorial comments to authors 16 May 2002; accepted for publication 26 June 2002