CHAPTER 1
Principles of clinical problem solving

Doctors constantly make decisions. It may not always feel like this. In fact, if we have been in practice for a while, it can begin to feel as if much of our practice is routine. This is because 'when things are proceeding normally, experts don't solve problems and don't make decisions: they do what normally works'.[2]

Part of becoming a competent doctor is learning the vast number of facts necessary to practice medicine. The more important part of our learning is to model the decision-making behaviour of more experienced clinicians, learning the routines that they use to collect and process the facts of each new case and thereby learn to make the sort of decisions that we all need to make as clinicians (see Box 1.1).

Our clinical training gives us the context and the experience to process the information of each new patient and to map it against our store of memorised facts. The way that we listen to and recount the stories of our patients becomes ritualised, with strict rules like a Greek chorus. The textbook facts that we have learnt begin to attach themselves to experience, to the stories of our patients and to our own experience of working in health care. We now know that clinical knowledge is mostly stored in memory as stories or templates, and not as collections of abstracted facts.[3] As we gain clinical experience, we are gradually able to use the details that we see and hear with better discrimination and with time we come to make decisions more or less intuitively, and may even find it difficult to explain the intermediate steps in our clinical reasoning (Box 1.2).

Box 1.1 Examples of Typical Clinical Decisions

- Should I do a test? Which test should I do?
- Could I be missing a diagnosis? Should I be investigating this patient further?
- Which of the available drugs should I prescribe? Would the patient be better without further medication?
- Is it alright to divide this structure during the operation – am I sure it is a vein and not a nerve. . .?
- Should I ask the patient to come back? When? How often?

Box 1.2 Characteristics of Novice, Competent and Expert Practitioners[4]

The novice practitioner is characterised by:
Rigid adherence to taught rules or plans
Little situational perception
No discretionary judgment

The competent practitioner:
Is able to cope with 'crowdedness' and pressure
Sees actions partly in terms of long-term goals or a wider conceptual framework
Follows standardised and routinised procedures

The expert practitioner:
No longer relies explicitly on rules, guidelines and maxims
Has an intuitive grasp of situations based on deep, tacit understanding
Uses analytic approaches only in novel situations or when problems occur

Because of our training and experience, we are able to practice medicine without considering in great detail how we come to make clinical decisions. Many expert and highly competent clinicians have not studied the principles outlined in this book. We believe, however, that learning the principles of clinical problem solving is important in order to provide the best possible care for our patients, and that understanding these principles will be increasingly important for medical care in the future.

Firstly, understanding the methods for clinical problem solving is important when a problem arises where we do not have a routine or practiced approach. By its nature, this happens more frequently in general practice than in any other area of medicine. It is probably no accident that the three authors of this book, and many authors who write in this area, come from general practice backgrounds. But being able to deal with new and complex problems and being able to manage uncertainty is important in all areas of clinical medicine. Being able to understand the principles of clinical problem solving is particularly important when we are relatively junior and have not yet developed enough clinical experience to act more intuitively.

Secondly, understanding these principles gives us a framework for incorporating both new evidence and the values of our patients into our clinical decisions. Evidence-based medicine is described as 'the integration of best research evidence with clinical expertise and patient values'[1], but it is not always clear to clinicians how this integration might occur. Two changes make it imperative to find methods for such integration. The first is the rate at which new medical knowledge is advancing. The second is the greater desire for patients to participate in decisions about their own health care. As another leader of

the evidence-based medicine movement described it: 'medicine is indeed in the middle of an intellectual revolution. Methods of reasoning and problem solving that might have worked well in the past are not sufficient to handle today's problems.'[5] The framework outlined in this book shows how the integration between clinical expertise, research evidence and patient values can begin to occur.

Thirdly, there are times when we can predict that intuitive or routine decision making might fail. Being aware of the potential cognitive biases in our routine thinking can help us to be better and safer doctors.

Finally, we have found that learning and thinking about the principles of clinical problem solving has improved our understanding of what we are doing as clinicians. All three of us have found that understanding these principles makes our clinical work more fun.

The framework for clinical problem solving

Studies of naturalistic decision making have shown that experts making critical decisions, such as fire commanders in charge of units fighting large fires, are often unaware of making any decisions.[6] This is even though they clearly have to make decisions such as the need for extra units, when to withdraw firefighters from a situation and so on. When asked to explain their decision-making process, the fire commanders will usually insist that they do not make decisions and that it is obvious what to do in any given situation. After analysis of how they actually made critical decisions, it seems that experts use their experience to match each new situation to a prototype, and to use this prototype to decide on a course of action. They may recognise that they need to collect more data to clarify a situation or to re-evaluate a situation if conditions change over time, but at each point they are trying to match the situation to a prototype. The main elements of the recognition primed decision-making model are shown in Figure 1.1. This model appears to be very consistent with what we know about how expert clinicians make decisions in medicine (Box 1.3).[7] For example, when a patient is admitted with a myocardial infarction, it is important to decide quickly whether a patient should have thrombolytic therapy or not. There are many factors that could determine this choice, but it has been shown, in fact, that doctors use only a few of these features to make the decision. Doctors are often better than clinical algorithms or decision support systems could be at determining when the clinical pattern does not fit. For example, a case report in *The Lancet* describes a patient who presented with chest pain and ST segment elevation in the anterior leads.[8] The medical team was preparing to give the patient thrombolytic therapy, when the patient remarked that he could not move or feel his legs. Recognising that this did not fit the clinical pattern of myocardial infarction, the team investigated further. A CT of the patient's chest and abdomen showed a thoracic aortic dissection.

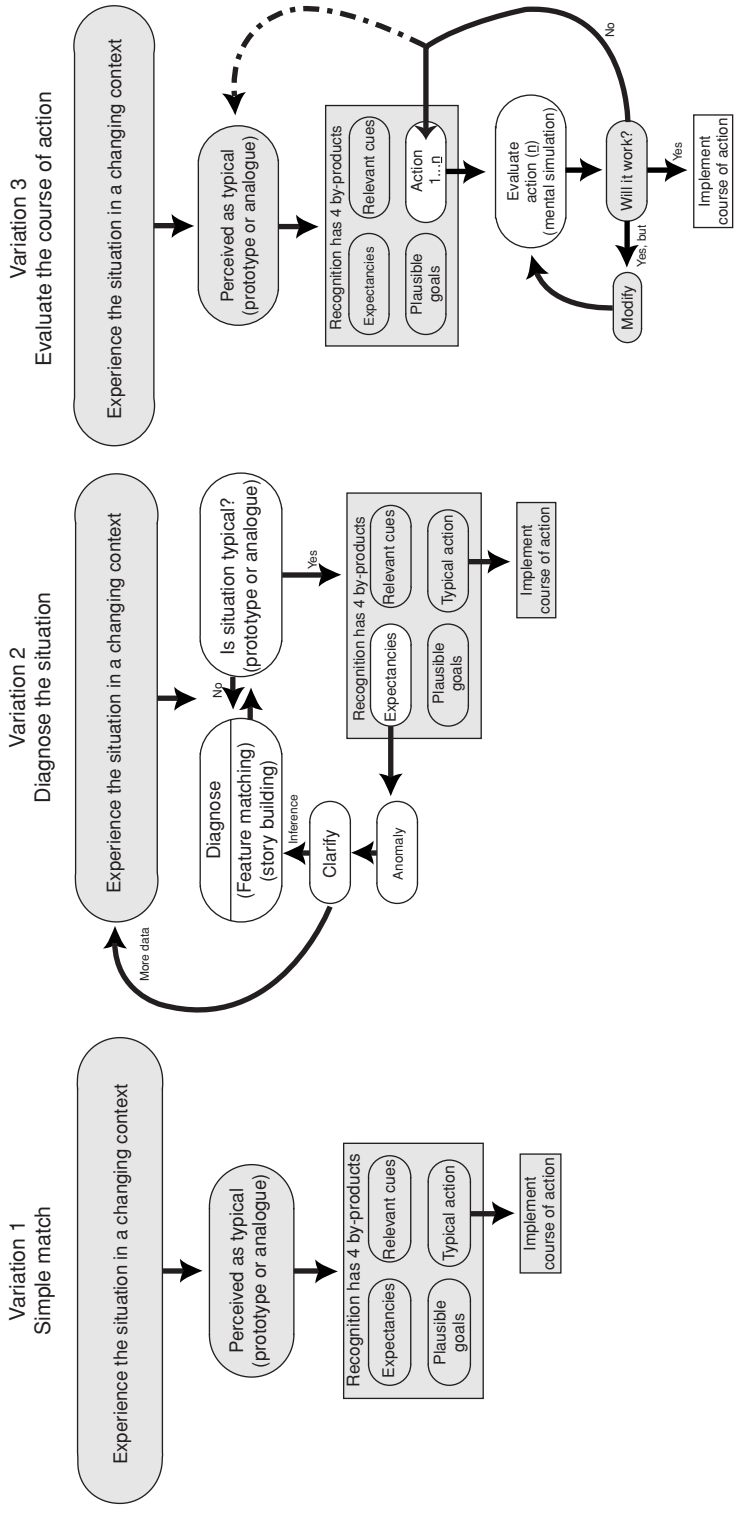

Figure 1.1 Recognition primed decision model.[6]

Box 1.3 The Case of a 28-Year-Old Man With a Fever and a Sore Bottom

During training as a general practice registrar, one of us saw a patient with these symptoms. I checked him carefully, but could find no cause for the fever (38.5°C). A *per rectum* examination revealed nothing specific (except it slightly exacerbated the rectal pain he had).

I told him I couldn't find the cause for the fever, and that it was probably an early virus infection (despite the lack of respiratory symptoms). I couldn't explain the rectal pain, but was reassured by the essentially normal examination. I suggested he should return if things got any worse.

But later that day, talking the case over with a more experienced general practitioner, he suggested ischio-rectal abscess. I had not thought of that. I rang the clinic, had the patient brought back, and referred him to hospital for investigation. It was as suspected, and he had a drainage operation later.

Later I wondered about the case. How was it the experienced GP had got this right? There were probably several factors. My obvious concern about the case (something was clearly not right: this is called 'dissonance from the expected'); the pattern that he recognised immediately; the diagnosis he had seen before; and the method of not 'missing' things – making sure that diagnoses that matter are checked out carefully.

An alternative model of decision making is based on rational choice strategies (see Box 1.4).[9] Using this approach, we can think of health care decisions as consisting of three major steps, with each major step having three minor steps (Pro-Act-Ive). We will lay out the steps in sequence (see Box 1.5), but it is important to keep in mind that the steps need not occur sequentially. Sometimes the choice in a decision becomes clear before all the steps have been taken; at other times, a later step will make it necessary to go back and repeat an earlier step in an iterative process. Also, it is important to recognise that doctors only use this approach with novel or complex problems. In situations where they are familiar with the problem and its diagnosis and treatment, they will act according to their experience and usually will not be aware of making decisions in an explicit sense at all.

Box 1.4 Decision–Making Theory

Many of the principles described here are based on medical adaptations[8] of rational decision-making theory.[9] Decision theory was originally developed to explain how economic organisations make decisions.[10]

Box 1.5 The Components of Decision Making: Pro-Act-Ive

	Mnemonic	Element	Tasks
Sorting out the problem	**P**	Problem	Define it. How does the diagnosis affect health?
	R	Reframe the problem	From multiple perspectives: think of everyone's, now and in the future
	O	Objectives	What is the best outcome we could achieve? Take into consideration other health influences and diagnoses
Action	**A**	Alternatives	List these, collapsing them into basic options: (e.g., treat; wait-and-see; *or* test)
	C	Consequences	Imagine the outcome of each alternative – especially nothing!
	T	Trade-offs	Often (but not always) it is worth talking treatment risks (e.g., surgery) for long-term benefits
Integration	**I**	Integration of	When pulling it all together for a decision, remember the patient
	V	Values	may have unexpected values.
	E	Exploration	These cannot be assumed and need to be explored with the patient

The Pro-Act-Ive approach to decision making in health care

Decision making involves a lot of steps. The Pro-Act-Ive mnemonic helps avoid missing any (see Box 1.5).

PRO – defining the problem and the objectives

P = defining the problem

The first step in any decision is to define the problem. In health care, this is not just deciding on the diagnosis. It means defining how the diagnosis or health care problem affects the patient.

> For example, type II diabetes is not generally a problem for patients immediately (which is why so many people are unaware that they have

the disorder). It is a problem because of the potential micro-vascular and macro-vascular complications that can occur over time.

We need to consider carefully how the diagnosis of a medical condition impacts on the life of the patient.

R = reframe the problem from multiple perspectives

When first thinking through a clinical problem, we need to think as broadly as possible. Many problems and the actions taken to address them can have unexpected consequences. Trying to think through the problem from as many perspectives as possible can help to ensure we have considered as many possible consequences as possible. Who is affected by the problem is also important. Any health care problem is likely to affect not only the patient, but also their family and their community.

O = focus on the objectives

After carefully considering the problem and its possible consequences, we can define the objectives that we are trying to achieve.

> While managing a patient with type 2 diabetes, we may decide to focus on minimising the risk of long-term complications, but there may be multiple other objectives. How important is it to avoid the side effects or complications from the treatment? Are there different objectives in the short- and the long-term? How will the patient's life expectancy and other health problems impact on these objectives?

The patient and the clinician need to agree on the objectives. It is clear that doctors often fail in this area.

> Doctors are unable to predict which patients are requesting a script for an antibiotic when presenting with a diarrhoea.[11]

Clinicians must never assume that they know or understand the objectives of the patient or that all patients will have similar objectives. Some clinical scenarios can make the different values and objectives of patients with the same disease very stark.

> Some patients with cancer will choose any treatment that gives them a greater chance of survival, no matter what the side effects. Others will prefer a shorter life span, but with greater quality of life.

As we will discuss in the next chapter, being able to come to a shared agreement on the objectives of management is one of the most important tasks in a consultation. Sometimes we will have intermediate markers that help us guide treatment.

> In managing diabetes an intermediate objective may be to normalise the HbA1c.

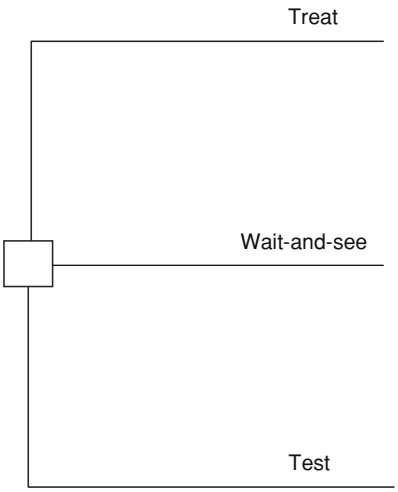

Figure 1.2 Generic decision tree.

However, we should not forget that this is an intermediate marker (a biological endpoint that has little effect on the patient's quality of life) and is useful only because it relates to our more fundamental objectives of trying to reduce the risk of long-term complications.

Act – determining the alternatives, consequences and trade-offs

A = consider all relevant alternatives

Once we have thought through the problem and the possible objectives, we need to consider all the potentially relevant alternatives. Sometimes there can be many complex and branching alternatives. We might want to collapse the many alternatives into some generic decisions to begin with (see Figure 1.2). Many clinical decisions can fit the generic model of: treat, wait and see and obtain more information (such as further tests).[8]

It is especially important to consider the wait-and-see alternative. Active intervention is not always necessary, or may not be the best option to fix a problem (as we will see in Chapter 6).

C = consider the consequences of each alternative and estimate the chances

To choose between several alternative courses of action, we need to consider the potential consequences of each alternative. This is the point that we begin to consider the evidence. Being able to find the best possible evidence on the potential benefits and harms of treatment can be critical to a decision.

> For example, if we are considering the management of a patient who has recently been diagnosed with type 2 diabetes, we have several possible management choices. We need to consider, for example, what is likely to happen to the patient if we begin with lifestyle interventions

such as diet and exercise? What is likely to happen if we begin with a sulphonylurea? Or a biguanide? What would happen if we did nothing? Could we combine some of these alternatives? How will each of these alternatives affect the patient's objectives? Are there other potential consequences not thought of in the context of the original problem, such as the patient's sense of empowerment? What are the potential costs to the patient and to the society of each action? Are there any potential harms?

T = identify and estimate the trade-offs

There can be many different consequences for each alternative course of action.

In the diabetes example, one alternative is better for some consequences (diet and lifestyle are cheaper and have other health benefits), while another alternative will be better for other areas (biguanides may normalise the blood sugar levels more quickly and help with weight loss).

We need to consider the potential trade-offs for the consequences of each alternative. Again, the patient needs to be central to this discussion. Different patients can place very different values on the potential consequences of each alternative.

Consider a patient who has suffered a transient ischaemic attack (TIA) and is found to have a carotid artery stenosis. The patient is at risk of a further TIA or even a stroke. But the surgery to correct the stenosis also has a risk of stroke or death. Is the patient willing to take a short-term increased risk of mortality against a better long-term prognosis?

Ive – integration and exploration

I = integrate the evidence and the values

Once we are clear about the possible alternatives, the potential consequences of the alternatives and the values we place on these consequences, we need to integrate this information so that we can make a decision. The best option may be obvious. In fact, laying out the options may make this apparent and further consideration unnecessary. At other times the decision will be more complex with important consequences developing from competing alternatives. It may be necessary to consider all or some of the above steps more closely. Sometimes the decision may be primarily probability driven (affected by the probability of the potential risks and benefits); at other times, it will be primarily value-driven (affected by the values of the patient) or it may be both.

There has been an ongoing debate whether patients with non-ST elevated myocardial infarction benefit most from an interventional approach (investigate all patients and provide revascularisation wherever possible), or a conservative approach (only investigate and revascularise with continued symptoms).

It appears that the decision depends both on the probability of benefit (which is related to the underlying risk of the patient) and the values of the patient (there is some early mortality risk but a longer-term increased chance of survival).[12]

V = optimise the expected value

Now that we have integrated all the available information, we can choose the alternative that has the consequences that best meet our overall objectives.

At this point, it is worthwhile reconsidering the dictum ascribed to Hippocrates: 'first, do no harm'. If it was truly our objective as clinicians to do no harm, we would be unable to instigate anything other than a few lifesaving medical or surgical treatments (maybe antivenene for snake bite). Every treatment has potential risks. The benefits of treatment are highly variable, as is the natural history of the disease.

Many patients with type 2 diabetes will suffer no health consequences as a result of their disease. Others will suffer severe complications, including renal disease, myocardial infarction and death.

We are only able to predict the potential benefits for groups of patients, not for the individual patient in front of us. As doctors, we are constantly trying to balance the potential benefits and risks of alternative treatment (including no active treatment) and trying to maximise the overall (net) benefits.

Not infrequently, our patients will have an entirely different and unexpected perception of the potential risks and benefits of treatment.

Some patients refuse interventions that appear to us to carry little risk (such as immunisation or X-rays), because of their view of the balance of risks and benefits.

We often need to know about them (see Chapter 2 on Communication).

E = explore the assumptions and evaluate uncertainty

There may be uncertainty that affects our ability to make a decision, particularly about the benefits of treatment or the values that our patients might place on the consequences. We may want to test how sensitive our final decision is by considering what our decision would be if we changed these values. Is one alternative clearly better? Or is it a toss-up (such as the management of NSTEMI discussed above)? If a decision is very sensitive to the size of the treatment benefit, we might want to 'invest' more time and effort in obtaining more accurate estimates of the size of the benefit for patients or for a stratified group of patients. For example, one strategy in the management of NSTEMI may be to identify those patients who are most at risk of further complications and who are therefore most likely to benefit from the more interventional strategy.

Recognition primed decision making versus rational decision making

To carry out each of the steps outlined in the Pro-Act-Ive model is obviously complex. Assembling all the information and constructing and analysing a decision analysis for a health care decision can be months of work. It is impractical to complete each of these steps to make a decision in a busy clinical environment. It is also not in line with what we know about how doctors make decisions in real life. In real life, we act much more in line with the recognition primed decision-making model, matching each new clinical situation to our past experience (in the form of stories and scripts) and act in accordance with what we know from our training and experience to do in that situation.

The rational decision-making model is still useful, however. It makes our decision-making process more explicit. When there is uncertainty about management or new information is available, we may want to invest the time (generally as a professional group) to develop and investigate the information, for example by writing a clinical guideline. The best form of these guidelines incorporates all the current evidence and explicitly states the potential harms and benefits of treatments. What guidelines cannot do, however, is to incorporate all the factors that may be important to a patient in making a decision, such as their own values and objectives.

Understanding the principles of the rational decision-making model is also helpful in everyday clinical decision making. Being aware of the alternatives, the potential consequences and the possible harms and benefits of our actions is enough to make us more aware and thoughtful clinicians. We do not need to be able to do a complete decision analysis to make these principles useful. Ensuring that we confirm the objectives and the values of our patients makes our consultations more 'patient centred'. Being able to systematically think through these principles allows us to explicitly consider the consequences of our clinical decisions, to incorporate the evidence on the potential harms and benefits and to incorporate the values of our patients into the decision-making process. It explains the place of clinical evidence in the decision-making process.

Summary

In this book, we will describe the general principles of clinical problem solving as they apply to all types of clinical decisions: diagnosis, prognosis, management, monitoring patients and so forth. We will describe both what is known about how doctors make such decisions, and ways that we believe can help doctors to improve their clinical problem solving. Our hope is that with greater understanding of these principles, doctors will be able to provide both safer and more patient-centred care.