

in this by political complications. In France a seventh year has been created in the same way as in Holland; they are advocating an obligatory vocational training for general practice, as in Italy where the situation is still difficult to judge with the impending nationalization of health care.

In view of this uncertain situation concerning vocational training for general practice in the EEC, the Working Committee on General Practice of the Standing Committee of Doctors of the EEC asked the Union Européenne de Médecins Omnipraticiens (UEMO) to propose a vocational training programme of not less than two years, a minimum duration already agreed on in 1966–67. This programme, drafted by the Dutch delegation, was based on the various definitions in use in different countries on the function of the GP in the first line of health care and on a description of his many varied tasks and qualities. It was thoroughly discussed at joint sessions of the Working Committee on General Practice of the Comité Permanent and the UEMO in 1969 and 1970 and was finally adopted by the General Assembly of the Comité Permanent; it was then sent to the EEC commission in Brussels.

Meanwhile, between 1969 and 1971 the draft directives for the free movement of doctors in the EEC were considered in the various EEC institutions and in 1971 arrived at the Council of Ministers. Many modifications have been proposed and some have been accepted, but none of these concerns the GP *sui generis*, let alone his vocational training. The UEMO and the Comité Permanent are most anxious that the directives contain some reference to general practice, perhaps even a recommendation by the Council of Ministers to the governments that they promote, for the sake of a good health care system in the EEC, the necessary vocational training for general practice. This training should be post-graduate and full-time and of a minimum duration of two years, of which six months should be spent in general practice. It should lead to registration in a special register for trained GPs and to a protected title, mutually recognized within the EEC.

*Addendum:* On May 13 1972 the General Assembly of the Comité Permanent in Rome accepted unanimously the draft recommendation, addressed to the Council of Ministers and the EEC commission, proposed by the UEMO and the Working Committee on General Practice of the Comité Permanent in concerted action.

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## Albert Wander Lecture

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### Problem-solving and Decision-making in Primary Medical Practice [Abridged]

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The purpose of this lecture is to examine the differences between the diagnostic process in family practice and in other medical specialties. I have avoided using the term diagnosis in the title because it begs the question. Medicine has yet to evolve a universally acceptable definition of diagnosis. It is well known, also, that general practitioners solve many problems without making a diagnosis in the sense of making a statement about etiology, or of assigning the patient's illness to a place in the taxonomy of disease (College of General Practitioners 1958). I have also used the term primary medical practice, to make the point that the special features of problem-solving in general practice are common to all those forms of primary medical practice in which the physician has personal and continuing responsibility for patients. Problem-solving and decision-making are not, of course, separate processes. The solution of a problem usually results in a decision. In the course of solving a clinical problem, however, we also make many decisions about what questions to ask the patient and what procedures to carry out. The problem-solving process is itself, therefore, a sequence of decisions.

#### *The Clinical Situation*

What happens when a doctor solves a clinical problem? There are a number of theories. The one I am going to describe here (and which is illustrated in Fig 1) is based both on experimental evidence (Kleinmuntz 1968, Elstein *et al.* 1972) and personal introspection.

The clinician's cues are symptoms, signs, the results of the pathological tests, and patterns of behaviour. Sometimes the cue is single; more often there is a cluster or pattern of related cues. Although in medicine the cues are occasionally certain, in the great majority of cases they are probabilistic. When presented with a probabilistic cue the clinician forms a hypothesis – or a number

of hypotheses – about the category to which the patient's illness belongs. When the clinician makes a number of initial hypotheses, he puts these in ranking order of importance. Three factors influence him in his choice and ranking of hypotheses: (1) His personal estimate of the probability of the hypothesis or disease (Lusted 1968). This is known as the conditional probability, because it is the probability of the disease, given certain presenting symptoms. Bayes' theorem provides a mathematical model for the calculation of conditional probability. (2) The seriousness of the disease. (3) The treatability of the disease.

The last two factors, when combined together, form the 'pay-off' or the benefits of a particular outcome. Obviously, the more serious the disease and the more amenable to treatment, the greater the 'pay-off' of making the correct diagnosis. If a disease has a high 'pay-off' it may be ranked high even though it has a low probability. In a child with abdominal pain, for example, acute appendicitis may be ranked high – even though of low probability – because of the high value of a correct diagnosis.

#### *The Use of Personal Knowledge*

Other conditions which affect the physician's estimate of probability are the patient's past history, constitution, previous behaviour and environment. These factors are particularly important in family practice because, nearly always, the doctor starts out with some previous knowledge of the patient. It would be interesting to know how frequently the family doctor uses information of this kind and how useful it is in comparison with his information about the frequencies of symptoms and diseases.

#### *The Search Strategy*

Having formulated his initial hypotheses, the clinician embarks on a search for attributes which will support or refute his hypotheses. The attributes the clinician seeks are symptoms, signs, and the results of tests. The experienced clinician looks first for those attributes which have the greatest utility in discriminating between categories.

In the course of his search, the clinician looks for both positive and negative defining attributes. It is obviously important that he should support his hypothesis, not only by positive evidence (the presence of attributes) but by negative evidence (the exclusion of other diseases). This is one of the chief purposes of the routine review of systems and the general physical examination. The extent to which we search for negative attributes and for unsuspected problems is one of the most difficult questions in family practice. It is obvious that a routine systematic enquiry is neither possible nor desirable in every case. The extent of this aspect of the search has to be related to the seriousness

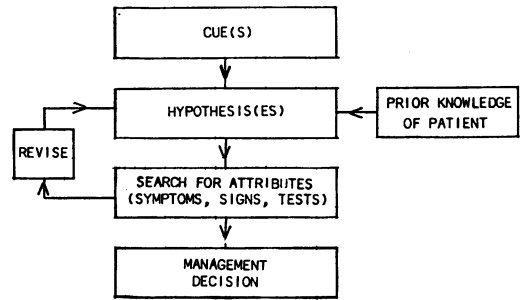


Fig 1 *The diagnostic process*

of the presenting symptom (Hull 1969). It is worth noting here that Bruner *et al.* (1956) and Kleinmuntz (1968) describe a general tendency in all problem-solving for positive instances to be preferred over negative instances.

Two other factors determine the course of the search and the point at which it is considered to have ended. First the objectives. These will vary widely between different types of clinician. There is an enormous difference between the objectives: 'to exclude serious illness' and 'to establish exact histological diagnosis prior to surgery'. Secondly, risk, benefit and cost calculations. The choice of actions taken in the course of the search is influenced not only by the utility of the actions, but also by the risks and benefits which follow from them. Any decision we take in the investigation or treatment of a patient can be analysed in terms of cost, risk and benefit.

One of the main features of the theory I have described is the formulation of hypotheses very early in the diagnostic process. As Elstein *et al.* (1972) have pointed out, this is contrary to the more orthodox view that clinicians collect a large body of data before formulating their hypotheses. The early formulation of hypotheses is theoretically very useful, for it converts the problem from an 'open' one, in which the end point is unknown, into the more easily handled 'closed' one, in which the end point is known (or at least hypothesized) (Bartlett 1958).

#### *Application to Clinical Specialties*

What factors influence the development of a common search strategy or clinical method in a specialty? The first, I think, is the tacit assumptions made about the type of problem likely to be encountered. Internists and psychiatrists develop their methods on the assumption that they will encounter organic and psychiatric problems respectively. The otolaryngologist assumes that he will encounter ear, nose and throat problems and omits a pelvic examination. The gynaecologist for similar reasons does not usually examine the ears or throat.

The second factor is the general utility of individual procedures. Why is ophthalmoscopy an important part of the internist's clinical method, but not laryngoscopy? Because ophthalmoscopy has a much greater likelihood of testing hypotheses generated by internists. The third factor is tradition. Our clinical methods are passed on from one generation to another. Although we tend intuitively to drop those with low utility, many of the things we do – and teach others to do – have never been subject to rigorous evaluation. Finally, the development of the common search strategy is influenced, like individual search strategies, by the general objectives of the specialty and by the risks and benefits of procedures.

The ultimate in uniformity of search strategy is a computer programme and it is interesting that diagnostic computer programmes have been developed chiefly for relatively discrete problems like congenital heart disease and endocrine disorders. The search strategies of specialists represent 'the end point of a total medical strategy, the first part being the pre-referral search by the family physician' (D H Smith 1972, personal communication).

**Problem-solving in Family Practice**

The special features of problem-solving in family practice are a direct result of the characteristics which are summarized in Table 1. In what respects is problem-solving in family practice different ?

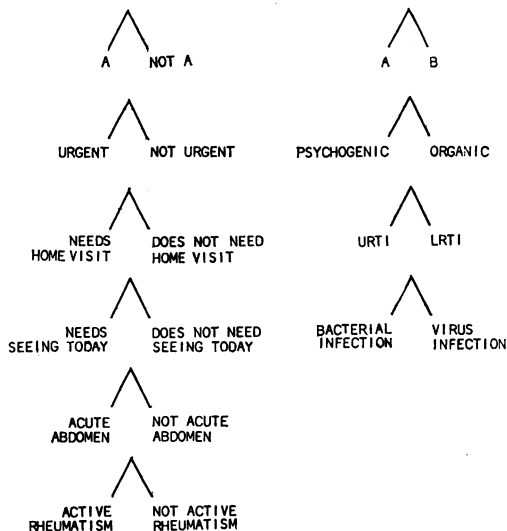
(1) By definition, no assumptions can be made about the type of problem likely to be encountered. Because of this, family doctors cannot develop, like other specialties, a common search method which will serve them for a large proportion of the problems they encounter. As Crombie (1963a) and Hull (1969) have described, the method must vary with the presenting problem and with the prior information about the patient which is already available.

Do family doctors develop similar search strategies for the same presenting symptom? Considering the similarity of their experience, we might have expected most primary physicians to

**Table 1**

**Features of primary medical practice**

- (1) The pattern of illness approximates to the pattern of illness in the community, i.e. there is:
  - (a) A high incidence of transient illness
  - (b) A high prevalence of chronic illness
  - (c) A high incidence of emotional illness
- (2) The illness is undifferentiated, i.e. it has not been previously assessed by any other physician
- (3) Illnesses are frequently a complex mixture of physical, emotional and social elements
- (4) Disease is seen early, before the full clinical picture has developed
- (5) Relationship with patients is continuous and transcends individual episodes of illness



**Fig 2 Categorization in primary medical practice: examples of binary categories. URTI, upper respiratory tract infection. LRTI, lower respiratory tract infection.**

use the same search strategy in dealing with a problem like fatigue. Hull's investigations (1972) suggest, however, that search strategies are not as uniform in family practice as we might think.

(2) The objectives of the family doctor are often different from those of a specialist. The family doctor sees many patients with self-limiting disorders. In these a precise diagnosis is not required: it is sufficient to know that serious illness has been excluded. Crombie (1963b) has called this 'eliminative diagnosis'. He also sees many patients with psychogenic disorders in whom the only categorizing task may be to decide whether the symptoms are psychogenic or organic.

In many cases, therefore, the objectives of the family doctor are to sort patients into binary categories (Fig 2). The objectives of the referral specialist are more usually to categorize the illness according to a system of disease taxonomy. If the objective is to sort the patient's illness into one of two categories, this will affect not only the end point of the search, but also the discriminatory tests which are used. The tests which are useful for discriminating between binary categories are often of little use for discriminating one from a larger number of categories. One excellent example of this is the ESR which we use so effectively for dividing patients into broad categories like 'active rheumatic disease' and 'no active rheumatism'. I find that students are taught that the ESR is of little value because it is so nonspecific. It is, of course, this very lack of specificity which makes the ESR so useful for the primary physician.

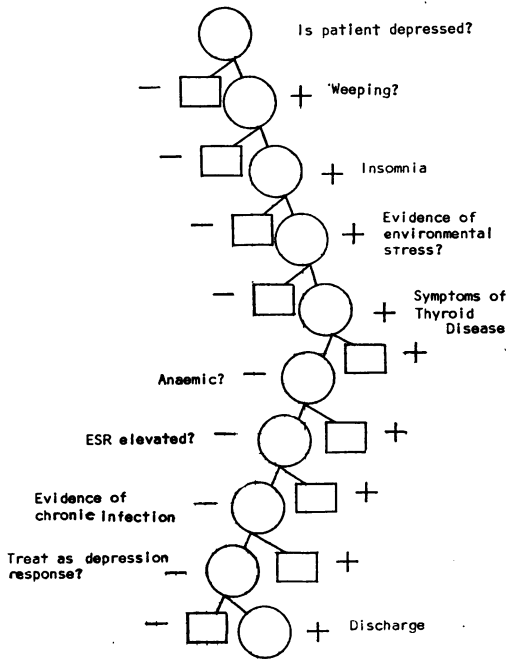


Fig 3 Binary tree illustrating physician's strategy in 30-year-old female patient with fatigue (after Kleinmuntz)

(3) Since the pattern of disease in family practice is similar to that in the community, the probabilities of disease are very different from those seen in specialty practice, where they are distorted by selection. This difference affects the choice of initial hypotheses and consequently the search strategy used. As an example I have taken a patient with depression presenting as fatigue, and Fig 3 shows in the form of a flow sheet my own concept of a logical search strategy. In family practice the probability of depression is so high that the search begins by looking for evidence of depression. The old adage 'exclude the organic', which usually meant 'look for organic disease first' does not hold good in these circumstances. When both the prior and conditional probabilities are so heavily in favour of a psychogenic disorder, it is irrational to begin the search by looking for

organic disease. You will notice that the initial hypothesis has been tested first by positive instances (evidence of depression), then by negative instances (Hb and ESR). Organic disease has been excluded, but after, not before, the collection of positive instances.

(4) The family doctor sees disease in its earliest stages, often before the full clinical picture has emerged. This has several consequences:

(a) At this stage, physical signs are often absent and decisions must be made on the basis of symptoms. This means that the history, important in any field of medicine, is of even greater importance in family medicine.

(b) Decisions have to be made without the help of defining attributes which become available in later stages of the disease. This means that decisions have to be taken at lower levels of probability than in the later stages of disease. This is not because the family doctor has no time to search for more evidence, but because the evidence is not available. Since diagnosis in all fields of medicine is probabilistic, this difference is quantitative rather than qualitative.

(c) The presenting symptoms of disease are often different from the symptoms described in textbooks. In other words, the cues available in the early stages are different from those available in the later stages. The doctor has therefore to categorize illnesses, not only with fewer cues, but with different cues.

(5) The family doctor deals with undifferentiated problems, many of which are complex mixtures of physical, emotional and social elements. Patients often present with two, three or more problems at the same time. Multiple cues are common, and these may be separate cues to separate problems or a cluster of cues all related to one problem. Important cues may be thrown in at any time during the problem-solving process, a situation illustrated in Fig 4. This can occur in any field of medicine, but I believe it to be more common in family practice.

Another result is that the family doctor has to pick up cues not only about the illness but about

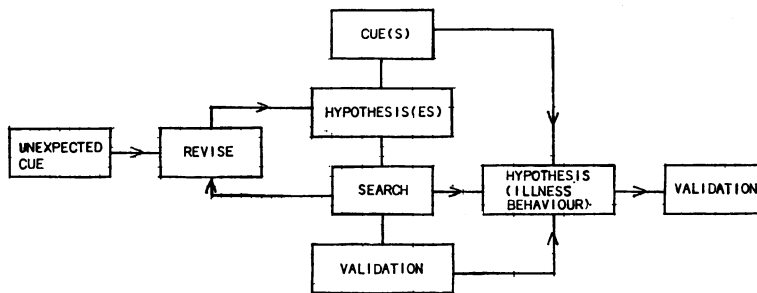


Fig 4 Flow chart illustrating unexpected late cues and cues to illness behaviour

the patient's behaviour, i.e. about his motive for attending and the social factors which lie behind the illness. This situation is also illustrated in Fig 4. Cues about illness behaviour may also be thrown in at any stage of the consultation. I believe that family doctors are especially adept at picking up cues of this kind.

(6) Doctors have to work to a time schedule. The family doctor differs from most in having a work load which can be manipulated only within certain limits. His search strategies have therefore to be highly appropriate to the task in hand and carried out with the maximum regard to utility.

#### *Implications for Medical Education*

A clinician's training takes place almost entirely in hospital, where each disease exhibits only a limited number of its total range of attribute values. The attribute values associated with the early stages of disease and with the less severe cases are excluded by selection. The selection process also distorts beyond recognition the pattern of illness in the general population. If we wish clinicians to discriminate between diseases in all grades of severity, and in all stages of evolution, it is surely necessary for some of their clinical training to take place in family practice.

Clinical textbooks are usually written about one part of the range of a disease's attribute values. When listing the signs and symptoms of a disease, a textbook will not usually comment on the discriminatory value of the symptom, or of its range of variation, or of its utility at different stages of the disease's evolution. It should be possible to write a textbook of medicine which is more in accordance with reality. With a change in the setting of clinical training and some new textbooks, it might become unnecessary for doctors entering family practice to relearn clinical medicine.

The second implication is that students should be taught to make clinical decisions in the way they are made by experienced clinicians. It has been customary to teach students a method of clinical diagnosis which is different from that used by experienced clinicians. The view has been expressed that the methods of experienced clinicians are short cuts which, although necessary, are less than perfect and should not be revealed to students. This I believe to be wrong. The best path to the solution of a clinical problem is the shortest which will solve it without avoidable risk. If the patient's problem has been solved in this way, then the diagnostic pathway was not a short cut but the optimum path.

The third is that students should be taught the theory of diagnosis. There are four reasons why this should be done. First, medicine has yet to feel the full impact of computers. When it does,

doctors will almost certainly be using computers as an aid to diagnosis and decision-making. Doctors who have no grounding in diagnostic theory will find it difficult to adapt to this change. Secondly, we are all going to face difficult decisions about the choice of investigations and treatment. Much of the increase in cost of medical care is due to increasing use of expensive resources by physicians. If they are to make effective use of limited resources, surely doctors should be aware of the cost-risk-benefit calculations which precede difficult decisions. Thirdly, it is, I think, a reasonable hypothesis that a doctor who has insight into his own thought processes will be a better clinician. And fourthly, it is an unjustifiable deception to conceal from students the facts of observer error and the probabilistic nature of all medical decisions.

And what are the implications for family practice? A skilled family doctor is a highly efficient and effective problem-solver and decision-maker. One of his greatest potential contributions to medical education is his teaching of these skills. To make ourselves effective teachers, two things are necessary. First we must increase our knowledge of the incidence and prevalence of disease, the significance of symptoms, the discriminatory value of tests, and the risks and benefits of our procedures and treatments. Secondly, we must learn to analyse, describe and justify the many intuitive judgments we make in the course of our day's work. A family doctor who has learned to do this, and who has at his disposal a developing body of facts, will be a highly effective clinical teacher.

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