

DECISION MAKING IN HEALTH AND MEDICINE

There is growing interest in the science of decision theory in both health and medicine. Although there have been sporadic papers in the medical literature using these techniques^{1,2,3}, the emergence of learned societies devoted to decision theory in medicine in both the United States and Europe has given impetus to the incorporation of these techniques into medical and surgical research. The European Society for Medical Decision Making held its fourth biennial conference in Marburg, Germany, in June this year. The range of topics was vast and the level of discussion impressive.

The meeting began with a choice of courses on decision theory and its mathematical background. An elementary course in fact dealt with Bayes's theorem, construction of the standard gamble and the elements of the decision tree. The advanced course introduced the concepts of neural networks in computer assisted decision making. The rest of the meeting was devoted to seminars and free papers on a variety of topics that have been considered with the use of decision-making techniques.

Decision theory deals with the science of decision making under various degrees of uncertainty. It attempts to provide methods for optimising decisions that have to be based on probabilistic data as happens with most decisions in both public health and medicine. Its basic mathematical tool is Bayes's theorem, which allows the revision of probabilities of occurrences in the light of new information. In technical terms it converts prior probabilities into posterior probabilities by a number of simple algorithms, which can be programmed into a computer. Given accurate knowledge of probabilities, it becomes possible to advise clinicians about optimal strategies in a given clinical situation. It is also possible to combine the probabilities of outcome with data describing quality of life and utilities, and to give measurements of benefit from a treatment program. Similar models can be used to examine the cost implications of all kinds of health policy decision.

There is no question that these techniques possess great power, and that they should be widely available in Australia to help those who make decisions at all levels of the health care system. They allow data from many sources to be pooled and used in an intelligible way so vast quantities of information can be harnessed and used to guide policy decisions.

It was generally agreed at the Marburg meeting that computers used with these methods assisted clinical decision making, but could not replace the clinician. The value of computer assistance varied inversely with the experience of the clinicians using the computer aid. Less experienced clinicians, for example, made fewer wrong diagnoses with computer assistance when confronted with patients who might have acute appendicitis; but experienced clinicians were not helped at all. As things stand, the computer can only help to educate the clinician — but this is no small achievement, and Dr Dallos from London produced objective evidence that interns trained with computer assistance learned faster than those trained conventionally.

Decision-making technology is useful in examining conventional practice for effectiveness and cost efficiency. Kievit from Leiden, for example, presented a study on ankle injuries, demonstrating that x-rays were not necessary unless a few simple clinical criteria were fulfilled. Avoiding x-rays for the majority of ankle injuries represented

significant cost savings for the Accident and Emergency Department of his hospital. Habbema from Rotterdam reanalysed a previous trial of treatment in subarachnoid haemorrhage, using information from a later study to reevaluate the decisions recommended by the original trial. Habbema demonstrated that the advice originally recommended was wrong for some groups of patients who stood to benefit from intervention. This capacity of decision-making techniques to combine information — after the style of a meta-analysis — is one of its most striking facets and one of its greatest powers.

The impact of this science on the larger scene is well illustrated in Dr David Eddy's review in the *American College of Surgeons Bulletin* of June 1992⁴. Dr Eddy presents a forceful critique of clinical decision making by conventional means, and a compelling reanalysis of the North American National Cholesterol Education Project. By resetting action levels in the protocol recommended by the study group, he has been able to show great cost savings with exactly the same patient benefit in terms of coronary occlusions prevented. Dr Eddy's work has attracted such attention that he is retained by the University of North Carolina as a Professor of Health Policy Research, although he lives about 3,200km from the university, and provides consultative services to many health agencies.

Decision-making techniques can benefit clinical practice, medical education and health policy formulation. Unfortunately they do not, yet, have an answer to the greatest continuing problem for both the individual clinician and the individual patient. This was confirmed by the single session at the Marburg meeting that was devoted to this problem. Medical information is essentially probabilistic, and all that these techniques can do is to narrow the confidence limits on the probabilities of any given outcome. To say to a patient with metastatic liver cancer that he or she has a 25 per cent chance of benefiting from surgical resection is meaningless for the individual patient. The response to that information will depend on the risk-taking propensities of both patient and doctor. Information of this kind will be presented in different ways by different clinicians, and will be interpreted in widely different ways by individual patients.

Dr Eddy⁴ foresees a brave new medical world, with a computer terminal on every clinician's desk top dispensing information that is constantly updated on the 'best' treatment for each condition. It may be some time before that vision is realised, but it would be something fine to aim for. For those dealing with health rather than medical practice, and for those who deal with large groups of people in their clinical research, the new era promises most. For the clinician dealing with someone with their own unique distress, the numerate future promises much less.

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