



## Daniel's message for doctors

Ken Cox

*The work of Daniel Kahneman shows that there is much more to clinical decision-making than the weight of numbers*

THE RESEARCH ON THE PSYCHOLOGY of decision-making by Daniel Kahneman (joint Nobel Prize Winner in Economic Sciences, 2002) is apposite to clinical practice. In parallel with Herbert Simon<sup>1</sup> (winner of the same prize in 1978), Kahneman linked behavioural sciences with decision-making in economics. Intriguingly, experts in the dry science of economics are slowly becoming aware that human choices are not based on numbers alone.

In conducting studies of decision-making, Kahneman found people's choices often differed from those that would be expected based on numerical probabilities alone. He examined the influence on the decision-making process of risk perception, risk-avoiding and risk-seeking behaviour, aversion to loss, distortion by hindsight, lack of statistical awareness, framing of choices, previous memories, and worries about the future.<sup>2</sup>

In the sphere of clinical medicine, teasing apart the factors that influence choices is necessary if we are to understand what goes through the minds of both doctors and patients. In life-and-death situations, survival overrides all other factors, and choices are based on the highest chance of survival. But Kahneman (with his colleague Amos Tversky) showed that, when the likely outcomes are less momentous, human factors can weigh more heavily than probabilities. In some situations, for example, the threat of a loss has a greater impact on choices than the chance of an equivalent gain.<sup>3</sup> Patients may be "loss-averse" in avoiding losing something important, such as their independence or their right to stay in their own home. In other situations, patients are not necessarily "risk-averse" — they may be willing to "take a chance on it" if the anticipated gain is large. Clinicians and patients accept high risks with low probabilities of success (say, in radical head-and-neck surgery for cancer) when the payoff from success is high.<sup>4</sup> Such behaviour parallels chasing jackpots and buying lottery tickets "against the odds". Quite apart from any health or financial motive, risk-taking has its own psychological payoff, which adolescent males relish.<sup>5</sup>

Losses disturb us emotionally, as we agonise retrospectively over whether they could have been avoided ("if only..."). We regret losses that flow from actions we have taken, such as buying shares that drop in value, more than from actions we could have taken but didn't, like not buying shares that rose in value. Clinicians use many devices (eg, prophylactic antibiotics and anticoagulants) to reduce the

threat of possible therapeutic loss from complications of treatment. They protect themselves from the threat, the regret and the losses from litigation by adopting defensive medicine and medical insurance.

Humans don't think probabilistically, especially at the upper and lower ends of the probability scale. For example, we are unable to meaningfully assess differences between 1% and 5%, or between 90% and 95%, in weighing our decisions. Kahneman and Tversky also showed that humans usually weight low probabilities too high and high probabilities too low relative to certainty. People tend to categorise some factors in "either/or" terms (say, that vaccination is either "safe" or "dangerous"), without incorporating any numerical likelihood in their choice. Another factor that can bias risk perception is fear and "imaginability" of a disaster. If you fall out of a boat, you may react dramatically to your fear of being attacked by a shark, even though you know the probability is extremely low.

Kahneman was Professor of Psychology at Princeton University, where John von Neumann and Oskar Morgenstern had developed "expected utility theory" in 1944. This theory of decision-making, incorporating all the outcomes and consequences of a decision, provided mathematical frameworks for "game theory", which underpinned strategic thinking during the Cold War.<sup>6</sup> This quantification of risks, costs and benefits of medical decisions is still used in healthcare today, but may lack credibility with patients, who are expected to assign a number, or betting odds, to the relative benefit of an outcome of treatment they haven't yet experienced. Rather than measuring *outcomes*, Kahneman and Tversky shifted the focus to measuring *change* — the gains and losses each individual experiences. Gains and losses have personal meanings to each of us, and are not objective, calculable units. Patients have difficulty assessing the value of a hypothetical treatment outcome, but they understand the known and the familiar. They don't wish to lose what is predictable and comfortable in their lives for the sake of a potential gain that they are unable to visualise.

The relative importance of gains and losses was further demonstrated when Kahneman and Tversky tested the effects on decision-making of how questions were "framed". Phrasing a question around the concept of "saving lives" shifted choices towards risk-taking; the same probabilities phrased around "lives lost" induced risk-averse choices.<sup>7</sup> Both patients' and doctors' perceptions of risk shifted according to how the choice between alternatives was phrased.

Kahneman's belief that numerical probabilities are the correct determinants of decision-making was one side of a "clinical versus statistical" war within the psychology of

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decision-making. Jeremy Bentham's utilitarian rule of the "greatest happiness for the greatest number" claimed that numbers from group data should override individual factors — his presumption that group data are "right" disregarded individual differences and contexts.

This issue also arises in the practice of evidence-based medicine. Management based on group outcomes may take precedence over management that is tailored to the patient's motivations and circumstances as well as the disease. Choice based on numerical probability works if only *one* outcome variable is being counted (say, survival after coronary artery bypass). But the situation becomes more complicated if the choice must incorporate multiple outcome variables, such as recurrence rate, complications, cost, return-to-work issues or level of anxiety. The complex interaction between other significant factors such as age, comorbidity, drug sensitivities, rehabilitation resources, coping skills and family support can swamp single-factor numerical logic, for better or for worse. Decision-making is not truly "rational" (and is ethically doubtful) when numerical variables are considered to the exclusion of all others.

In this context, we must acknowledge that, in our discussions with patients, we often use vaguely quantitative terms, such as "frequent", "likely", "common", "rare" and "possible". These approximations honestly reflect the real world of partial knowledge within which decisions are made. If

clinicians don't use, and don't know, the predictive probabilities that shape their therapeutic decisions for each patient, attempts to weigh significant numerical variables against one another to reach a decision may be no more than pseudo-accuracy.

We need to develop a little "science of the individual" that can weight all the human and medical factors at play, together with a calculus for clinical judgement that guides the parties to a decision most likely to optimise the chosen outcomes. A Nobel Prize may be waiting for the clinical researcher who cuts a sound and workable path through these complexities of the real world!

## References

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## time capsule

### The influenza and other epidemics

The profession has to thank you [the Journal] for your dignified protest against the hysteria and exaggeration which has distinguished the press of Sydney in connexion with the present epidemic. I believe in those three millions dead in India about as much as I believe in the three millions who accompanied Xerxes over the Hellespont. Both numbers simply signify Oriental historians' and American journalists' ideas of a large number, and are incredible. And when the *Herald* says outright that this is the most terrible visitation that has ever attacked mankind, and that it has killed more people than the war, one wonders whether one is awake or dreaming.

Journalists ought to read history. I wonder is there a single one in Sydney who has ever read a detailed account of the Black Death; and yet that was the turning point of history and the source of almost all the troubles which afflict society today. There is no doubt that it was to a large extent the ordinary bubonic plague . . .

. . . We have so long been certain that no other disease but the plague could have caused such a catastrophe that we cannot bear to think that there may possibly be another. Was it pneumonic plague? . . .

It does seem to me quite possible that at the time of the Black Death there was for the first and only time in history a combination of the plague and the strange disorder which is now knocking at our doors. Hence the unparalleled mortality.

In early 1919, before the full force of the influenza pandemic was felt in Australia, there were doubts expressed in the Journal about the veracity and balance of media reports.

But that does not justify us in calling this disorder by the dreadful name of plague. . . .

. . . the Oriental plague . . . rendered cities almost uninhabitable for thousands of years, till about 1700, when man conquered that dreadful enemy without his knowing how he had done it. He began to lock up his foodstuffs and his stores of grain; he built his houses

better; perhaps he became cleaner in his habits; in other words, he kept the rat at a distance, and, without the rat, . . . you can have no plague.

The story of the plague is the most dreadful in all that narration of the crimes, follies and misfortunes of mankind which Gibbon called history. It has slain uncalculable millions; during the Middle Ages it was the unquestioned Captain of the Men of Death; it was probably almost the normal cause of death for centuries; no man can even venture to guess at what the world might have been had there been no plague. And yet our hysterical journalists apply that name of awful omen to the comparatively harmless disease which we have so far kept at bay. . . .

But once more I wish to emphasize the hysterical folly of fixing the dreadful name of plague on to this influenza. Let us thank our God that we shall never more be subject to that terror of the human race.

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*Med J Aust* 1919; 1: 71-72