Reflections

The Monte Carlo fallacy

Gambling and diagnostics are related, but strangely reversed, in the way that prior events can affect our clinical judgements.

The year was 1913; the location, the roulette tables of a Monte Carlo casino. For the previous 10 spins of the wheel, the ball had landed on black. A red was overdue, so the punters began to bet more aggressively against the trend. But the 11th spin produced yet another black number. As did the 12th, and the 13th … and the longer the run of blacks continued, the more convinced the gamblers became that the subsequent spin would yield a red. Their wagers accelerated. Their losses snowballed. For it was only after 26 consecutive black numbers (by which time few could afford to continue betting) that the streak finally came to an end. It was perhaps the most profitable night in the casino’s history: records were set, fortunes were lost, and the “Monte Carlo fallacy” was born.

Also known as the “gambler’s fallacy”, it describes the erroneous belief that the outcomes of recent random events have some bearing on future random events. It dictates that if a flipped coin yields 10 consecutive heads, then the likelihood of a subsequent tails is increased, because the coin seems “due” for a tails. Intellectually, we know this law of averages makes no sense: a coin has no memory, so every time it is flipped, there is an equal chance of either side appearing face-up, regardless of what happened on previous flips. Certainly, the odds of flipping heads 10 times in a row are remote — one in 1024, to be exact — yet this number also represents the odds of having any other pattern of heads and tails in a 10-flip series. Although we know this to be the case (undoubtedly, so too did many of the gamblers on that night in Monte Carlo), it is all too tempting to disregard the laws of probability and be seduced by pseudologic.

In our clinical practice, it is similarly easy to be fooled by apparent patterns, and unduly influenced by any recent experiences that remain prominent in our minds. However, for clinicians, the Monte Carlo fallacy seems to work in reverse: rather than a string of similar events prompting us to think we are “due for a change”, we may instead feel that the “run” is more likely to continue. For example, if, within a short space of time, two patients presenting with hypotension are found to be hypoadrenal, then it may be tempting to look for this unusual diagnosis in all future hypotensive patients, even though other diagnoses may be more common, more likely, and easier to diagnose without expensive investigations.

If a patient has a fall while in hospital, and then dies unexpectedly from an unidentified intracranial bleed, we may feel compelled to request a brain scan for any subsequent patient who has such an accident. We may do this even when the patient appears unhurt, and our clinical judgement would otherwise suggest that such a test is not indicated.

While the outcome for the first patient was tragic, it in no way affects the likelihood that a second patient’s (unrelated) fall will also have life-threatening complications — just as the first 25 black roulette numbers had no bearing on the outcome of the 26th. Our approach to any clinical situation is guided by the accumulation of our previous experiences, but somehow the most recent ones seem to bear the most weight.

Ultimately, we are human, and humans are pattern-seeking creatures. We see faces in amorphous clouds, and stars scattered across the night sky form images before our eyes. And to this pattern-seeking ability we owe much of our understanding of medicine: the linking of infection outbreaks to geographical areas has identified sources of contamination, and the observation of disease trends has revealed unrecognised side effects of drugs. A great deal of our knowledge today has been acquired through observing the unusual, the unexpected and the uncommon, and continuing to do so will certainly teach us more. However, in day-to-day clinical medicine, the old maxim rings true: common things occur commonly.