5 pitfalls in diagnosis and prescribing: psychological biases that can lead to poor judgement

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Running title

Biases in medical decision making
Summary points

- Psychologists have extensively studied the cognitive processes involved in making decisions

- Heuristics and biases that can lead to poor decisions are widespread, even among doctors

- Awareness of the cognitive processes involved in making decisions can reduce the risk of making poor decisions
Introduction

Psychologists have studied the cognitive processes involved in decision making extensively, and have identified many factors that can lead people astray when making decisions. As doctors make decisions that have profound effects on their patients’ health, it is of particular importance that those decisions be of the best possible quality. All doctors should therefore be aware of the pitfalls in medical decision making and take steps to avoid these unnecessary errors. In this article, I present five examples of cognitive biases that can affect medical decision making, and offer suggestions for how to avoid falling prey to them in practice.
**The psychology of decision making**

To make correct decisions in clinical practice, doctors must first gather intelligence on which to base their decisions. According to decision-making experts Russo and Schoemaker [1], the best way to do this is:

1. Ask the most appropriate questions
2. Interpret the answers properly
3. Decide when to quit searching further

Straightforward though it may sound, there are pitfalls at all steps in this process. In addition to cognitive biases that can lead to suboptimal decisions, strategies that provide shortcuts to decisions—heuristics—have also been identified. While heuristics often allow people to make appropriate decisions quickly, they are not infallible and can sometimes also lead towards poor decisions [2].

It would be tempting to believe that doctors, as highly trained professionals, are immune to cognitive biases. Unfortunately, doctors are just as prone to the unwanted effects of biases and heuristics on their decision making as anyone else [3–5]. In fact, it is a common trait for those who are particularly prone to cognitive biases to believe that they are good decision makers [1]. As Shakespeare put it, ‘The fool doth think he is wise, but the wise man knows himself to be a fool.’ [w1]

Studies based on both simulated cases and questionnaires have shown that doctors are susceptible to cognitive biases [6, 7]. Specific biases in doctors’ decision making include insensitivity to prior probabilities [7], overconfidence [w2], failure to consider alternative options [w3], the attraction effect [w4], and the availability heuristic [w5].
However, training in the dangers of cognitive biases can reduce the probability of biased medical decision making [w6].b
**The 5 pitfalls**

*Pitfall no 1: the representativeness heuristic*

The representativeness heuristic is the assumption that something that appears similar to other things in a certain category is itself a member of that category. Often, this is a sensible assumption to make, but sometimes it is not. In particular, many people regard representativeness as being more important than other information which may be statistically more reliable, such as the prior probability that the item is a member of the category.

The strength of the representativeness heuristic was demonstrated in a classic experiment by Kahneman and Tversky [8]. They presented subjects with descriptions (see web extra 1) of people who came from a fictitious group of either 70 engineers and 30 lawyers, or vice versa, and asked the subjects to rate the probability that the person described was an engineer. Clearly, this probability is much greater for a population of 70 engineers and 30 lawyers than for one of 30 engineers and 70 lawyers. However, subjects’ estimates were affected only to a small extent by the information about the number of engineers in the sample. They were much more affected by the extent to which the description corresponded to the stereotype of an engineer (e.g., “Jack is conservative and careful”), showing that representativeness had a greater effect on the subjects’ judgements than knowledge of prior probabilities.

The effect of the representativeness heuristic has also been shown in a nursing context. A group of qualified and student nurses were given two fictitious scenarios of patients with symptoms suggestive of either a heart attack or stroke, and asked to give a diagnosis [9]. In addition, the heart attack scenario sometimes also included the
situational information that the patient had recently been fired from his job, and the stroke scenario that there was a smell of alcohol on the patient’s breath. The situational information had a highly significant effect on the diagnosis, and made it less likely—consistent with the representativeness heuristic—that the nurses would attribute the symptoms to a serious physical cause. Interestingly, the effect of the situational information was similar for both qualified and student nurses, suggesting that training had little effect on the extent to which heuristics influenced diagnostic decisions.

The way to avoid being led astray by the representativeness heuristic is to be aware of not only how likely a particular occurrence appears to be, based on specific information, but also how likely it is a priori in the absence of that specific information. In other words, it is important to be aware of base rates of a particular occurrence, such as a diagnosis under consideration. This information should not be ignored: if a disease is extremely rare, it may still be unlikely to be the correct diagnosis even if a patient has typical signs and symptoms of that disease.

**Pitfall no 2: the availability heuristic**

When we use the availability heuristic, we place particular weight on examples of things that come to mind easily. This may be because they are easily remembered or recent. In general, this will guide us in the right direction, as things that come to mind easily are likely to be common occurrences, but it may also mislead. For example, the availability heuristic is apparent after a major train crash, when some people are prompted to travel by car instead of by rail, incorrectly believing that car travel will be safer [w7].
In the medical setting, one study had doctors judge the probability that medical inpatients were bacteraemic. The probability was judged to be significantly higher when doctors had recent experience of caring for patients with bacteraemia, showing that doctors were influenced by the availability heuristic [10].

Another example is the well documented tendency of doctors to overestimate the risk of addiction when prescribing opioid analgesics for pain relief [11, 12, w8–w11]. Severe pain is often undertreated as a result of reluctance by doctors to prescribe opioids [11]. In some cases, this reluctance may be justified, but it is often a result of an unwarranted fear of prescribing opioids, or opiophobia [12]. Opiophobia results largely from a tendency to greatly overestimate the risk of addiction or dependence in patients who receive opioids [13]. The risk of addiction or dependence is actually very low when patients receive opioids, particularly controlled-release ones (which do not provide an immediate ‘high’), for the treatment of pain [14, 15]. The reason for this overestimation of the risk of addiction could be a result of the availability heuristic: opiate addiction tends to receive high publicity, and this may lead to an overestimation of its real risk.

To avoid falling prey to the availability heuristic, it is important to be aware of the factors influencing a decision. Is the decision influenced by any particularly salient pieces of information? Are these pieces of information truly representative, or do they simply reflect recent or otherwise particularly memorable experiences? Awareness of the extent to which information used in decision-making is truly relevant, rather than simply easily available, will help to avoid being led astray.
**Pitfall no 3: overconfidence**

It is common to place greater reliance on one’s own knowledge than is warranted. To use our knowledge effectively, we must be aware of its limitations, but many people are rather poor at assessing the gaps in their knowledge, tending to overestimate how much they know (see web extra 2 for an example).

Overconfidence can come into play when doctors rate their own clinical skills. Larue et al found that both primary care doctors and medical oncologists had important shortcomings in their attitudes and knowledge of pain control, but, despite this, rated their own ability to manage pain highly [16].

The dangers of overconfidence are obvious. Doctors who believe their management of a condition to be better than it is may continue to prescribe suboptimal treatment, without realising that their management of the condition could be improved. Also, overconfidence in diagnostic abilities may result in too hasty a diagnosis, when in reality further diagnostic tests are needed.

It is important, therefore, always to be aware of the limits of one’s own knowledge, and to ensure that knowledge is kept up to date. Simply being aware of any shortcomings in one’s own knowledge is a great help, as it will mean that further information will be gathered before making a decision. It can also be helpful to actively try to think of reasons why your decision may be wrong [17].

**Pitfall no 4: confirmatory bias**

Confirmatory bias is the tendency to look for, notice, and remember information that fits with one’s pre-existing expectations. Similarly, information that contradicts those expectations may be ignored or dismissed as unimportant [1, 2].
Confirmatory bias has been shown to affect peer-reviewers’ assessments of manuscripts. Mahoney sent fictitious manuscripts with identical methods, but with different results sections, to peer-reviewers [18]. Where the results sections supported the reviewers’ presumed pre-existing beliefs, the reviewers gave significantly better ratings of the methods sections than when the results contradicted their beliefs.

Once again, doctors are not immune to confirmatory bias. In taking medical histories, doctors may ask questions that solicit information that confirms early judgments, and might also stop asking questions because they reach an early conclusion, thus leaving key information unsolicited. More generally, the interpretation of information obtained in the latter part of a medical work-up might be biased by earlier judgments [19]. Further, the confirmatory bias can lead to medication errors. It is natural to expect that the drug you are about to administer is the correct drug. This may mean that apparently obvious information that you have the wrong drug—for example, a label marked 'ephephrine' instead of the expected 'epinephrine'-is ignored or misinterpreted to confirm your expectation of having the correct drug [20].

The danger of confirmatory bias is likely to be particularly marked when making decisions about diagnosis; however, treatment decisions are not necessarily immune to this kind of bias. To avoid this bias, it is important to remain constantly vigilant for any information that may contradict your current view, and to give any such information careful consideration, rather than dismissing it as irrelevant. It is often sensible to try to think of specific reasons why your theory might be wrong, and to ask questions that could potentially disprove your theory. Always be aware of alternative hypotheses, and ask yourself whether they may be better than your current ideas.
**Pitfall no 5: illusory correlation**

Illusory correlation has some overlap with confirmatory bias. It is a tendency to perceive two events as causally related, when in fact the correlation between them is coincidental or even non-existent. The link with confirmatory bias arises when causes that fit with pre-existing ideas are noticed.

Homoeopathy provides an excellent example of illusory correlation. Homoeopaths will often notice when patients improve after being treated with a homoeopathic remedy, and claim this as evidence that homoeopathic treatment is effective. However, there is no convincing evidence that homoeopathic treatments actually are effective [w12, w13]. It is likely that this is simply an example of illusory correlation, and homoeopaths are particularly likely to remember the occasions when their patients’ improvement follows homoeopathic treatment.

Falling prey to illusory correlation can reinforce incorrect beliefs. This can lead to persistence of suboptimal practices. A straightforward way to avoid illusory correlation is simply to keep written records of events which you believe to be correlated, making sure that all relevant instances are recorded.
Summary and conclusions

Doctors often have to make decisions quickly. However, the greatest obstacle to making correct decisions is seldom insufficient time, but more commonly distortions and biases in the way information is gathered and assimilated. Being aware that decisions can be biased is an important first step. I hope that this article has pointed out some areas where decisions can be particularly prone to biased thinking. It must be borne in mind that in real-life clinical decision making, biases do not necessarily fit neatly into any of the above categories, but may result from a complex interaction of different factors, potentially increasing the potential for poor decisions still further.

It is worthwhile training yourself to realistically assess what you know and what you don’t know. It is important to be aware of what extra information is needed to make a decision, and once that information has been obtained, not to distort it. One of the best ways to avoid distorting information is to actively seek reasons why your decision could be wrong.
Provenance

Jill G. Klein is trained in social psychology (Ph.D., University of Michigan, 1990) and has spent much of her academic career conducting research on biases in impression formation. Sources cited in this article were derived from extensive searches of Medline and Embase.
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Web extra 1

For example, one of the descriptions in Kahneman and Tversky’s study was ‘Jack is a 45-year-old man. He is married and has four children. He is generally conservative, careful, and ambitious. He shows no interest in political and social issues and spends most of his free time on his many hobbies which include home carpentry, sailing, and mathematical puzzles.’
**Web extra 2**

The extent to which people are overconfident can be demonstrated by asking them to guess ten different quantities which they probably do not actually know, but might be able to make a guess at, and to place a low and high limit to each guess such that they are right 90% of the time. For example, try to guess the total surface area of the Mediterranean Sea, and put a 90% confidence interval around your guess ([click here for the answer](#)). In theory, 9 out of 10 such guesses should include the true value in the confidence interval. In practice, however, most people only score 3–6 out of a series of 10 similar questions [1]. This shows that there is a tendency for people to overestimate their confidence in their own knowledge.

Answer (put on separate web page if possible): The total surface area of the Mediterranean Sea is 2,510,000 square kilometres or 970,000 square miles.
References

1. Russo JE, Schoemaker PJH. Winning decisions: how to make the right decision the first time. London: Piatkus; 2002


**Web extra references**

w1. Shakespeare W. As You Like It. Act 5, Scene 1.


w7. BBC News. Your initial reaction to London's rail disaster. 


