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Review article

# An overview on cognitive aspects implicated in medical decisions

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ABSTRACT

Cognitive theories on decision making show that individuals often do not decide in a full and rationale way, but instead use cognitive strategies that allow them to overcome the limitations imposed by their limited rationality and the difficulties derived from uncertainty. The first part of the paper will discuss the role of heuristics and biases in medical decision making. This is an interesting field of research since medical decisions must be fast and are often complicated by rapid changes in the patient's clinical condition, uncertain prognosis and unexpected or uncontrollable treatment effects. In such contexts individuals are forced to rely on heuristics to assist them in taking decisions which can sometimes produce cognitive biases.
The second part of the paper will be dedicated to discussing ways in which the patients' decisions can be improved. The role of the shared decision making approach will be discussed as well as the role of decision aids. Based on personal information coming from the physical and psychological characteristics and needs of the patient, decision aids give information about specific options and outcomes related to the patient's disease. Provided with a set of well-defined alternatives, patients are assisted in taking their preferred decisions, especially when there is more than one medically reasonable opinion available. Moreover, decision aids facilitate and support the shared decision-making, a process by which patients and physicians discuss and evaluate the alternatives for a particular medical decision together.


## 1. Theoretical framework

Patients' health and quality of life depend on two main factors: decisions made by physicians and patient's compliance. Decisions concerning a diagnosis or treatment, especially in the case of serious diseases, can often make a difference between life and death, while patient's compliance is fundamental to the effective delivery of health care. Therefore, it is very important for physicians to make the best possible decisions and for patients to understand their clinical situation and to follow medical recommendations.

However, there is a growing awareness of suboptimal physicians' decisions [1], that are often not attributable to professional incapacity, but to cognitive failures occurring during the clinical decision making process. Such suboptimal decisions can sometimes lead to adverse consequences for the patient. Therefore, better patient care and health outcomes can be accomplished by an improved decision making process on the side of the physician.

With regard to the patient, it is a common and well-documented phenomenon that many patients do not adhere to the recommended health-care behavior [2] often because they have biased beliefs concerning medical approaches and treatments [3]. For these reasons, frequently they do not perform health-oriented behaviors, do not attend medical encounters, do not follow medical advices, and show poor comprehension of treatment benefits and poor communication or lack of trust with their health-care providers. This can also be described as a considerable contributor to suboptimal health outcomes and even death.

In order to help physicians and patients to make better decisions, medical decision making research mainly focuses on two sets of interdependent objectives [4]. First, it investigates how physicians, other health-care providers and patients make decisions, not only in experimental, but also in real-world settings. Second, researchers try to find ways to facilitate the shared decision making process between patients and physicians, developing appropriate decision tools to assist them in the decision making process.

This paper aims to provide an overview on medical decision making from a cognitive perspective. In the first section, traditional decision making models and research will be described in order to demonstrate that descriptive, rather than normative, decision making models appropriately describe how physicians and patients make decisions. The second section analyzes heuristics and biases that physicians and patients use when confronted with complex and complicated decisions in the medical context. In the third section, shared decision making model will be described. Furthermore, the last section gives an overview on decision support interventions that aims to facilitate a shared decision-making process between physicians and patients.

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## 2. Normative versus descriptive theories of decision making

Traditional decision making models can be divided into two different approaches, the normative and the descriptive approach. Normative approach models describe how people should make decisions, whereas descriptive approach models describe how people actually make decisions.

The 'Expected Utility Theory' developed by von Neuman and Morgenstern [5] is one of the most well-known normative decision making models. It assumes people to be fully rational decision makers and it is based on the idea that in making decisions they should be able to maximize their gain [4] by having complete information about the probabilities and consequences concerning each possible course of action.

However, there is evidence that, instead of being fully rational, most human decisions are influenced by cognitive, psychological and emotional factors that often prevent decision makers from choosing the best options available. As first noted by Simon [6] people are characterized by a "bounded rationality", that means that human cognitive abilities are limited and cannot consider all the information available. These limited computational capacities prevent individuals from implementing the normative models in real situations since it is highly improbable that one could figure out all the alternatives, and all the consequences that follow each alternative.

Apart from than bounded rationality, two other factors are critical in the way in which individuals make decisions in real life contexts: uncertainty and risk. Ignored by the normative theories, uncertainty and risk received considerable attention in the descriptive theories that are models describing the way in which individuals take decisions in real life situations. In particular, according to the "Prospect Theory", a descriptive theory developed by Kahneman and Tversky [7], decision makers act in dynamic and nontransparent circumstances characterized by missing data and ambiguities. This is particularly true in medical contexts in which decision making processes can be further complicated by rapid changes in the patient's clinical condition, uncertain prognosis, unexpected or uncontrollable treatment effects, and by the fact that decisions must be taken under time pressure and with consequences that may be irreversible [8–11].

Regarding risk, according to the Prospect Theory, when facing risky situations people are generally risk-averse regarding gains whereas they are risk seeking with respect to losses. For this reason, it is thus important whether a decision problem is framed in terms of losses or gains because this can lead to different decision outcomes. Taken these insights into account one is able to influence people's choices by framing options in a certain way. A study by Meyerowitz and Chaiken [2] showed that this is of high relevance in the medical context. Using the concept of loss aversion the authors tried to encourage college-aged females to do self-examination for breast cancer. Participants were presented with one of three different pamphlets. The first pamphlet was a loss-framed pamphlet which means that it contained arguments stressing the potential losses and negative consequences resulting from non-adherence to breast self-examination. The second pamphlet was framed in terms of gains meaning that it included persuasive arguments concerning the positive consequences of performing breast self-examination. A third pamphlet did not include any arguments. Immediately after the intervention and 4 months later the women's attitudes toward breast self-examination as well as their intentions to perform it were measured. Results showed that women provided with the loss-framed pamphlet reported more positive attitudes toward breast self-examination, had more positive intentions and also reported a higher increase in breast self-examination than did women in the other two conditions. These results are explained by the fact that performing breast self-examination can be identified as risk-seeking behavior because fear of finding a lump was a frequently mentioned reason for non-adherence among women. In contrast, performing breast self-examination can be seen as a risk-averse behavior. In terms of Prospect Theory, arguments included in the loss-framed pamphlet were encoded as losses and arguments contained in the gain-framed pamphlet were encoded as gains. As losses loom larger than gains, women were more likely to perform breast self-examination as arguments and consequences were framed in terms of losses. Loss of health protection was thus regarded as more important than an equal gain in protection. The results of the study clearly suggest that framing of choices is especially important in the medical context and that the concept of loss aversion can be applied in order to improve health outcomes.

Taken together, these findings suggest that when people make decisions, they are not adhering to the assumptions made by normative decision models. On the contrary, decisions are for a great deal influenced by cognitive limitations, personal preferences, and psychological and emotional factors that influence the way in which they choose between the available alternatives.

## 3. Heuristics and biases in medical decisions

Despite cognitive limitations and uncertainty individuals must continuously take decisions. To do it they are forced to rely on simplifying cognitive short-cutting strategies, called heuristics, which assist them in taking decisions especially when only incomplete or poor information is available [8]. The advantage of relying on heuristics is that they reduce time and effort that would have otherwise been required in order to make reasonably good judgments and decisions. However, there is also a disadvantage of using heuristics because there are instances in which they lead to systematic cognitive errors called biases [13–15]. Following the work done more than 30 years ago by Tversky and Kahneman [9], in 1987 the first eight heuristics and the related biases were described [10]. In 2002 eight became thirty [11] and now there are over 50 [12]. Many of them considerably influence the process of decision making and have been well documented in the context of all medical disciplines [4,11–13], although they are most prevalent in internal, family, and emergency medicine [14–16] (Table 1).

To better explain what they are and how they influence medical decisions eventually leading to systematic errors, we will describe here three of the most well known heuristics and three well known biases.

### 3.1. Representative heuristic

Representativeness heuristic can be described as the "assumption that something that seems similar to other things in a certain category is itself a member of that category" [17]. Thoroughly described by Kahneman and Tversky [7,18] in their works on descriptive theories, it can easily be applied to medical decisions as well. In fact physicians often use it to match symptoms of the patient against prototypes or mental templates of diagnoses. However, relying on the representativeness heuristic can lead a diagnostician to only look at and search for the prototypical manifestations of a disease [19]. This can lead to an incorrect or delayed diagnosis when aspects of a patient's presentation are atypical. In some instances, the reliance on the representativeness heuristic leads to a 'base-rate neglect'. Base-rate neglect includes the failure to adequately take into account the prevalence of a particular disease [20]. When the true prevalence of a disease is ignored, it may lead to the overestimation of improbable diagnoses, which, in turn, is disadvantageous for the patient and can result in an over-utilization of resources.

### 3.2. Availability heuristic

Availability heuristic can be described as the tendency to overestimate the frequency of things if they are more easily brought to mind. Things are judged to be more frequently occurring if they come to mind easily, probably because they are remembered without difficulty or because they were recently encountered. The underlying assumption of