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The role of patient involvement in the diagnostic process in internal medicine: A cognitive approach

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ABSTRACT

Much cognitive and clinical research has addressed clinical reasoning, pointing out that physicians often have difficulties in following a linear course when making accurate diagnoses. Some authors suspect that physicians make mistakes because they unknowingly fail to observe the laws of formal logic and that their reasoning becomes influenced by contextual factors.

In this paper, we introduce some basic principles of the cognitive approach to medical decision making and we describe the cognitive balanced model. Then we discuss the relationship between construction of mental models, cognitive biases and patient involvement by the use of a clinical vignette.

Medical decisions may be considered fundamentally biased since the use of judgment heuristics and a combination of cognitive-related and system-related factors limit physicians' rationality.

While traditional understanding of clinical reasoning has failed to consider contextual factors, most techniques designed to avoid biases seem to fail in promoting sound and safer medical practice. In particular, we argue that an unbiased process requires the use of a cognitive balanced model, in which analytical and intuitive mind skills should be properly integrated.

In order to improve medical decision making and thereby lessen incidence of adverse events, it is fundamental to include the patient perspective in a balanced model. Physicians and patients should improve their collective intelligence by sharing mental models within a framework of distributed intelligence.

1. Introduction

The diagnostic process is probably the most relevant component in medical decision making from a cognitive point of view. In fact, physicians need to work like an information processor, which collects data from the environment, infers judgments and produces clinical scenarios. Much research has been devoted to this important topic but most is superficial, both when it succeeds and when it fails. Actually, diagnostic error accounts for a substantial portion of all medical errors, receiving increased attention in the last 30 years [1]. However, it is astonishing that the error rate seems to remain constant over time and space, as demonstrated in two studies (one in the US and one in Germany) which indicate how the error rate has not substantially changed over since 1980, remaining firmly anchored in both countries at a rate of around 10%, although alarmingly a recent systematic review reported a rate as high as 24% [2].

Generally speaking, most errors are reported to occur within the information analysis stage. Physicians declare failures or delays in identifying significant clues and in prioritizing clinical information. In this stage, physicians, as any other expert decision makers, need to gather data from the environment and to organize them onto a so called mental model. Indeed, the human mind works on well-structured data that may be represented and cognitively processed, in order to define a problem, highlights solutions and takes actions in a cognitive loop (see Fig. 1). Thus, all the incoming information needs to be weighted for relevance and tested for reliability before being integrated in a mental model [3].

The activation of a first mental model starts with the diagnostic process. In fact, using this mental structure based on schemes stored in the long-term memory, a physician may evaluate the consequences of each possible choice (diagnostic or therapeutic interventions), in order to plan future actions, choose scenarios, or even review the active mental model.

A number of studies have highlighted the complex nature of making medical decisions, which cannot be considered a cognitive exercise completely based on rational and technical skills [4,5]. In particular, cognitive research has shown that the clinical setting is influenced by heuristic processes, intuition and a number of biases, or cognitive illusions, that can lead a physician far from ideal clinical reasoning [6]. Recent studies showed that it is possible to understand and prevent errors in internal medicine starting by the recognition of the interaction between cognitive-related and system-related causes [7] and learning to detect early warnings [8].

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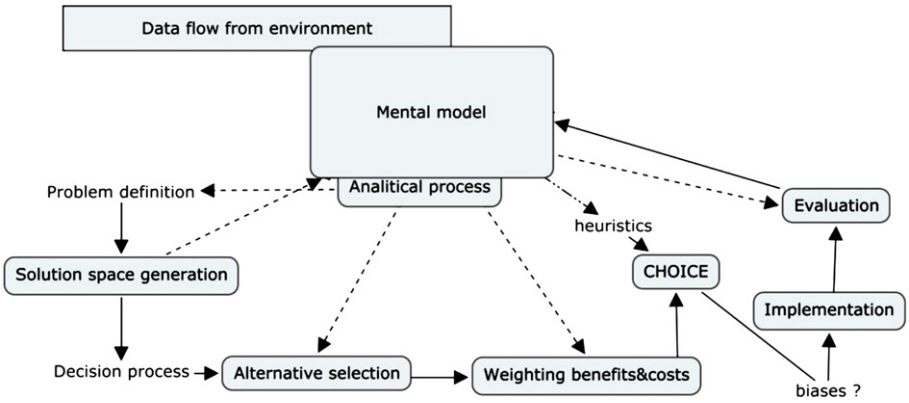

Fig. 1. A schematic representation of the decision making process. In particular, the scheme highlights the role of the mental model in guiding the cognitive course (analytical versus heuristic).

2. A cognitive balanced model

In previous work [9], we have defined a cognitive balanced model to describe how the clinical decision setting should be represented by a functional balance between analysis and intuition, that is, between the two basic components of the human mind [10]. The cognitive balanced model is based on the assumption that the use of concepts and logical reasoning should be developed in medical education along with specific training within the realm of intuitive skills. In particular, it emphasizes the importance of developing specific awareness about of the need for balance, since the lack of awareness will inevitably expose physicians and patients to clinical hazards. Indeed, an overconfidence in analytical skills or the underestimation of the importance of implicit thought will increase the likelihood of falling into cognitive traps [11], and failure to understand the origin of many errors.

Of course, the development of analytical skills and intuition follows different paths. To follow logical and analytical schemas it is necessary to learn general methods, specific concepts and techniques as well as how to apply them in certain domains.

Intuition, in contrast, is developed with experience, essentially during everyday activity and thus it is difficult to plan training specifically aimed at developing intuitive skills. However, it is possible to design education programs compatible with the needs of the intuitive mind. Generally speaking, a strong learning environment [12], characterized by consistency, regularity, timely feedback and meta-cognitive moments can be considered to be “pro-intuitive” [13].

Medical practitioners must learn to trust their intuition, but also to know its limits. In particular, intuition is much more powerful and reliable, when functioning within the specific context in which it was developed. Doctors' expert eye should not be transferred automatically from one medical context to another.

The cognitive balanced model highlights how these meta-skills should belong to the cognitive background of a doctor. Without this background, error prevention protocols and techniques to cut down biases will always be partial solutions [14]. The cognitive balanced model also implies that doctors should be properly supported in both their training, and in their clinical everyday practice by specific decision aids. However, also these support systems should be designed to balance the strength of analytical methods with the need for intuitive evaluation. In contrast, most existing support systems have a cognitive architecture mainly based on analytical algorithms and static knowledge structures such as decision trees and deterministic decision-making methods.

Furthermore, our perspective proposes use of general processes that can be analyzed as a whole, instead of addressing simple and elementary “mind bugs”. In particular, while agreeing with the literature data [15] we argue that there are two general conditions that often lead to an unbalanced decision-making process and to potential adverse events: overconfidence bias and premature closure.

Premature closure is the tendency to avoid considering other possibilities after reaching a diagnosis, while overconfidence bias is the tendency to overestimate one's judgment ability. Premature closure can lead to stopping the diagnostic process even before a favored diagnosis is actually confirmed by appropriate clinical examination. It should derive from a strong cognitive load which depends on several factors (personal, inter-personal and contextual) and is time-dependent. More specifically, premature closure may be the result of the combination of an individual's need for cognitive closure along with certain contextual factors. It is obvious that intuitive thinking is strongly associated with premature closure, even if specific training could teach physician both to trust in their intuition and to activate subsequent meta-cognitive control on it.

Also overconfidence is a consequence of a number of direct and indirect drivers, including age and experience. In particular, overconfidence bias seems to be particularly significant for expert doctors, since they have developed sound competences and confidence in them.

Interestingly, experienced physicians are as likely as novices to exhibit premature closure and indeed senior physicians may be particularly predisposed both to premature closure and overconfidence, probably because of the development of age-related cognitive constraints [16].

The special importance that overconfidence and premature closure seem to play in the diagnostic process probably lies in some basic mind processes. The overconfidence bias leads to the creation of a conservative mental model, ready to use, and the need for closure exerts pressure to confirm the same mental model in order to avoid cognitive and emotional overloading. A particular mental model, by itself, can also contain complex analytical processes and procedures, incorporating both intuitive and analytical knowledge. Nevertheless, a lack of awareness about decision making mechanisms may lead to the use of unbalanced models.

In order to avoid the cognitive pitfalls it would be desirable to implement an unbiased process in which incoming data are organized in a mental model that highlights essential information and leads to a safer diagnostic process.

However, we propose that a balanced process cannot really be effective within a clinical context if it is built in isolation from the context. The medical scenario includes different actors, in particular physicians and patients. To avoid errors and to strengthen the power of cognitive processes, mental structures should be shared and the related intelligence distributed.

3. Patient involvement and error prevention

Although progress has been made in a number of specific areas of prevention of errors, the patient's role in protecting and promoting his or her own safety has long been neglected.

The scientific literature on this topic is scarce, despite some positive cognitive studies which have suggested that this may be a fruitful area to cut down errors. Indeed it has been observed that patients seem to be quite efficient in detecting errors and reporting risk situations.

Patient involvement in error detection and prevention has been recommended, for example, by the US Institute of Medicine, the American Hospital Association and by some clinical experts [17–19]. In particular, the involvement of patients is thought to be vital in avoiding errors in administration of drugs, which cause many adverse events. Different studies in internal medicine departments showed that prescription-related errors are not rare and that in the last decades error rate did not substantially change. In particular, errors are originated by incomplete, duplicative, or contradictory orders or by the failure to adjust dosages for comorbid conditions.

For instance, in a two-year prospective study on nurses [20], 141 drug administration errors were found on 4.752 hospitalizations. Forty one percent of these errors were errors in planning (omission of the administration and measurement checks), 21% were errors in writing or transcription of prescriptions and 38% were errors in dispensing drugs (mainly wrong dose or wrong medication). Most researchers suggest to adopt corrective measures by the implementation of a computerized physician order entry system that allows the elimination of transcribing errors and permits the introduction of alarm systems. However, we argue that an active patient involvement is equally important.

Administration of medication in cancer patients is particularly critical, given the narrow therapeutic window of cytotoxic drugs. Patients undergoing cycles of chemotherapy may be able to participate in error prevention, since being exposed to similar procedures several times may enable them to adopt clinical abilities.

These skills might be considered as the result of the development of clinical competences (knowledge of the therapy, pharmacodynamic principles, methods and procedures) acquired by undergoing continuous clinical testing, inspections and treatments. The repeated experiences over time, allow the acquirement of a set of adaptive strategies for patients to take control of their therapeutic journey [21,22]. If properly informed and motivated, patients have the capability to play an important role in the prevention or at least diminution of adverse events. Yet little research has been undertaken on how to effectively engage patients in this role of “watchful partner” in their own healthcare [23,24].

In one study [25] doctors were asked to assess the perceived effectiveness of fourteen recommended actions to prevent errors. Results indicated that most actions were considered effective. However, respondents also indicated that the possibility to be involved in similar actions in their daily activity were improbable. Having a greater self-efficacy of being able to prevent medical errors is significantly correlated with a higher probability to report and to be engaged in preventive actions. For instance, feeling able to involve patients in medical decision making and adverse event prevention will increase the probability that a physician will actually work to involve each subsequent patient in their medical journey. To improve patients' involvement, thus, physicians need specific training to increase self-efficacy and not just a general set of guidelines.

Clearly, the desire for involvement and participation in the healthcare process and shared medical decision making also depends on certain characteristics of patients. Age, gender, level of education and personality traits are all factors capable of modulating the need for involvement and the ability to be a pro-active patient. Generally speaking, younger patients tend to report a greater desire for involvement than older patients. Women seem to prefer a more active role than males, as do patients with more time in higher education. Younger and more educated patients have a greater ability to obtain and understand health-related information and thus they will be more likely to become involved in health-related decisions [26].

Past experience and the specific disease characteristics are other components to be considered in understanding a patient's ability to be involved [26]. For instance, patients who have had a recent myocardial infarction, coronary angioplasty or bypass surgery are more prone to seek involvement in medical decisions, compared to those patients who have no history of cardiovascular disease.

4. The relationship between patient involvement and cognitive traps: an example

Patients can be critical to the efficiency of the diagnostic process, as illustrated with the following example.

Mr. Smith went to the emergency department with a severe abdominal pain. The pain arose suddenly, starting from the solar plexus and spread though to his back, persisting for several hours, before the decision to go to the nearest hospital. Here, after a brief giving a complete history including careful description of his pain, he had an electrocardiogram and blood tests to rule out a myocardial infarction. This having been ruled out by normal tests, he was given analgesic drugs and a proton pump inhibitor, and discharged to the care of his family doctor.

After a second acute episode, the family doctor referred Mr. Smith to have an esophagogastroduodenoscopy. The endoscopic examination did not indicate the presence of gastroesophageal reflux and also the histological results of biopsies were negative. A diagnosis of moderate chronic gastritis was made and he was recommended to continue with the same therapy plus small fonts of butylscopolamine as required. The patient continued to suffer painful episodes which became increasingly difficult to control with his prescribed drugs so Mr. Smith decided to consult a specialist in gastroenterology. After a brief history and description of symptoms, the specialist read the report of the previous endoscopy and then, having briefly examined the patient confirmed the diagnosis of chronic gastritis, agreed with the existing medications and suggested some diet changes.

Despite good general health, Mr. Smith continued to experience episodes of acute pain, only partially controlled by butylscopolamine and began to lose weight, put down to the results of the dietary restrictions and physical exercise. Eventually, after four referrals to the emergency department in 18 months for acute pain, each time being recommended the same painkiller and sedative treatments, and the refusal of further investigation he was seen by a surgeon who suspected that the pain might be due to biliary colic. A careful ultrasound confirmed the existence of gallstones and after hospitalization he was found to have signs of hepatitis and pancreatitis. The patient was subsequently operated for removal of his gall bladder and stones, and discharged from hospital free of pain for the first time in 2 years.

The case of Mr. Smith, is not uncommon and has various interesting facets, most critically the total absence of involvement of the patient in the diagnostic process. Mr. Smith was considered by the many doctors who met him (his family doctor, specialists, emergency department internists) as a mere symptoms and signs carrier. It is obvious that after the first diagnosis the mental model of the subsequent doctors was built instantly on it (so-called anchoring process) [27].

Indeed, the first question when encountering a patient coming to the emergency department with a painful condition is often “did you already suffered from stomach problems?”. A positive response (“I have been diagnosed with gastritis”) will automatically elicit the activation of a mental model that will guide the subsequent actions.

Once the pain goes away, the patient does not bring any more information and thus may be discharged, in order to rapidly close the case (in fact, the emergency department internist won't see the patient anymore). The patient will not be asked for further information about his state of health (for example, with respect to weight loss), nor will his request for further investigation be heeded.

In practice, the use of a stand-alone mental scheme, not to be shared with the patient, caused an overconfidence bias and subsequently the need for a premature closure determined the course, and the end of clinical reasoning among Mr. Smith's caring professionals.

The last surgeon observed the patient without the filter of the initial framing information, since his clinical history was collected anew from the patient, independent of the previous fat file of case note. In this way, the surgeon was guided only by his cultural background and expertise that led him to build a mental model specifically focused on the symptoms which he ascribed to colic. We argue that greater patient involvement in medical decision-making would have allowed internists to doubt their own mental model and share with the patient a more flexible one. In this way, Mr. Smith would not have suffered a 2 year delay in diagnosis.

Of course, this case could be construed as a classic case of delayed diagnosis due to a biased mind process, however, it is our opinion that it is essential to consider also the patient involvement issues to improve our ability to appraise the whole situation. In fact, the overconfidence bias and the premature closure acted not only on the individual doctor, preventing a balanced logical thought process, but also on the relationship with others, in this case with the patient.

Lacking technical expertise and specific knowledge the patient was overwhelmed by each physician's confidence in their decisions. Subsequently premature closure precluded the use of, or the search for further data, such as marginal signs and perpetuation of the patient's complaints despite what should have been appropriate medication.

A doctor/patient relationship model based on openness and sharing would have allowed the patient to declare his doubts, to better describe the characteristics of this pain (as well as his other symptoms), and to have the confidence to make effective requests for alternative management. In this way, Mr. Smith's legion of doctors would have been able to observe their own mental models from a different perspective and to assess more objectively the next steps to be performed. In this way, any of them could have activated a balanced thought process, avoiding the insidious cognitive traps, particularly the overconfidence bias (see Fig. 2) into which the internists in our example inevitably fell.

5. Conclusion

The paradigm of cognitive balanced model is not only a theoretical framework that allows us to create a sort of metaphorical description of clinical reasoning. But also, the cognitive balanced model helps focus attention on all those mechanisms (both at individual and social levels) capable of unbalancing the clinical reasoning in one way or another. A lack of awareness about the functioning of the mind and the failure to elicit a shared context give rise to double imbalance in the diagnostic process, consequently doubly-dangerous.

The active involvement of the patient can be a powerful mechanism to balance the cognitive course also within the realm of the diagnostic process and not only in oncology or chronic diseases. According to our model, the involvement of the patient represents a solid anchor for clinical reasoning in many clinical scenarios. However, this entails a change of paradigm, since the physician must be able to shift from the construction of an individual (stand-alone) mental model (much simpler to build and to manage) to a shared mental model, according to the paradigm of distributed cognition [28]. The patient and the doctor, in this way, would work as a small team, sharing information, purpose and decisions [29]. The sharing and the co-construction of mental models to be used during the diagnostic journey is a mechanism for increasing the collective intelligence (in this case the community is made up of the doctor-patient duet), which acts as an error pre-emptive tool [29–31].

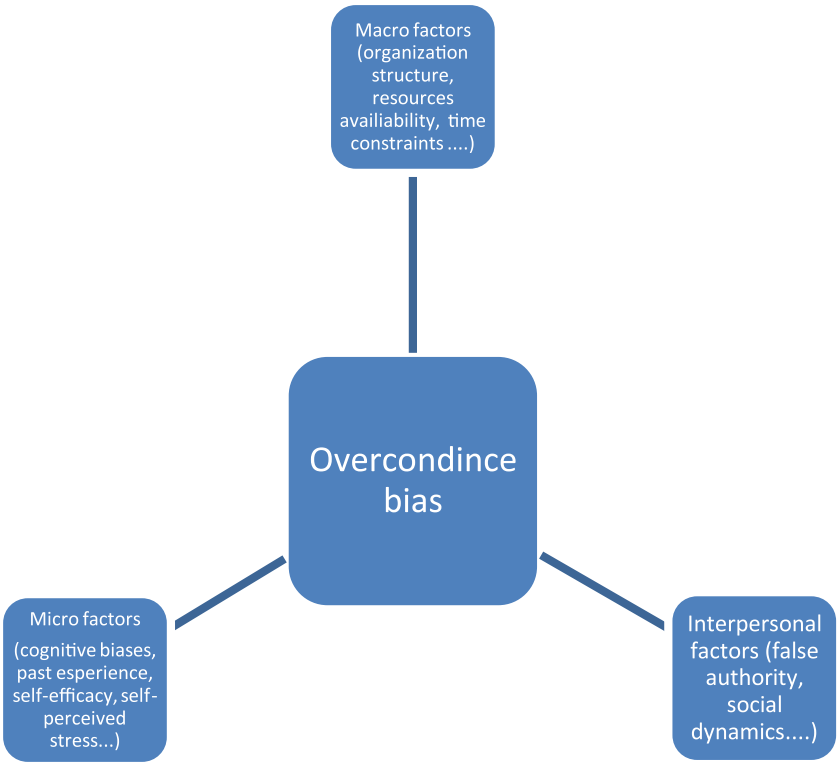

Fig. 2. Factors determining physicians' overconfidence in a stand-alone setting. The expert mental model may be very efficient, but also too rigid. The encounter between expert's and patient's mental models may add flexibility and reduce the impact overconfidence bias.

However, building a distributed cognitive model is much more complex and requires skills that many doctors did not have the opportunity to develop in their education or professional experience. It will therefore be a task of higher education agencies to help clinicians in this direction, in order to significantly contribute to reduce medical errors. Even if it is possible to plan the use of sophisticated decision support systems to prevent misdiagnosis events (as the one we described), we argue that the first step toward a safer diagnostic path is the active involvement of patients. Any other devices will be useful tools to be used within a paradigm of shared cognition between patients and physicians within a balanced cognitive model.

Learning points

- Cognitive biases are often underrated in clinical settings.
- Overconfidence biases and premature closure cause often diagnostic errors.
- Patient involvement may be useful in reduce the impact of cognitive biases and preventing diagnostic errors.

Conflict of interests

The preparation of this paper did not involve any conflict of interests.

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