

Difficulties of medical decision making



One of the pioneer works in exploring medical decision making by Lusted and colleagues suggested that clinical reasoning was based on logic, probability, and value theory [1]. In their work Ledley and Lusted outlined a physician explanation of medical diagnosis process as follows:

First, obtain the case facts from the patient's history, physical examination, and laboratory tests.

Second, evaluate the relative importance of the different signs and symptoms

Make a differential diagnosis that is list all the diseases which the specific case can reasonably resemble.

Exclude one disease after another from the list until it becomes apparent that the case can be fitted into a definite disease category, or that it may be on of several possible diseases or its nature cannot be defined

Ledley and Lusted[1] analysed the reasoning foundations of medical diagnoses introduced the concepts of mathematic reasoning to medical diagnosis, tried to formalize medical diagnosis by logical relations to represent medical knowledge that is the physician's knowledge about relationships between symptoms and diseases and open medical science for methods of decision-making and computer sciences.

Approaches to decision making explored by decision researchers are:

Normative theory (how people ought to decide if they act rationally – that is mathematically correct) [2]. Descriptive theory (how are decision actually made? and the prescriptive theory (how can decision theory be used to

improve decision?) Over the past 30 years decision theory and its applied form, namely decision analysis have become a multidisciplinary area involving knowledge from a wide range of areas such as philosophy, organisational theory, computer science, economics, psychology, clinical psychology, clinical practice and clinical education sociology, statistics, computer science, artificial intelligence [refs many, bell, 2], the respective affiliation of various fields to either the normative or descriptive theory is shown in figure 3

Figure 3: The different subjects from where knowledge comes into the arena of decision making.

Normative model of medical Decision consist of the expected utility theory (the normative theory of choice under uncertainty) and multi attribute theory, bayes' theorem provides a normative approach to the sequential processing of medical data characterized by subjective probability [2]. Descriptive theories like the information processing approach which was developed further into a hypothetico-deductive strategy consider diagnostic decision making as hypotheses generation task. Individual pieces of information are evaluated to confirm or refute the hypotheses[2]. Normative decision theory and decision analysis-both help make patient preferences accessible for clinical decision- making [2, 3], a number of data mining techniques like decision tree, neural networks, support vector machine etc. can be used to implement decision analysis

Nowadays, decision analysts talk of prescriptive decision support and prescriptive decision analysis as being the application of normative ideas,

mindful of the findings of descriptive decision studies, to guide real decision-making[4, 5]

“...mathematicians (decision theorists) are interested in proposing rational procedures for decision making ... Psychologists are interested in how people do make decisions. ... A third group, the methodologists, the consultants ... are concerned with ...how to improve the quality of decisions in practice? ... methods (are needed) that incorporate the insights gained from normative theories, but in a way that recognizes the cognitive limitations of decision makers”[4].

So, the effort of prescriptive decision theory is to help decision makers solve real decision problems and to focus on one problem at the time.

Consequently, part of the aim of this work is to incorporate the normative, descriptive techniques in the area of clinical reasoning and decision-making.

In order to develop decision support application based on knowledge discovery and data mining techniques thus it is of great importance to know the similarities as well as the differences between the three theories[4]: The prescriptive theory deals with the art, science of practical decision making and can be viewed as the engineering side of the normative theory[6].

Moreover, the prescriptive theory is very much concerned with the identification of the discrepancies between real (descriptive) and idealised (normative) behaviour in decision making and to help make better decisions. Examining the criteria by which they are evaluated can also illustrate the differences between the three models.[4]

- Empirical validity is the criterion used when evaluating descriptive models, i. e. to what degree they correspond to observed choices.

- Theoretical adequacy is the criterion for evaluating normative models, i. e. to what degree they provide rational choice; and

- Pragmatic value is the criterion used when evaluating prescriptive models, i. e. how well they can provide suitable help to a decisionmaker to make better decisions (Bell et al., 1988).

Clinical reasoning

Quite few concepts used to describe clinical reasoning in healthcare (clinical decision making, medical problem solving diagnostic reasoning) [2, 7], (clinical judgment, clinical inference) [7]. Clinical reasoning is the process use in solving patient's problem based on clinical data, knowledge and professional judgment [2] [8].

Different strategies aimed at decision making use in clinical reasoning are Hypothetico-deductive or diagnostic reasoning [2, 9, 10], Decision analysis, [2, 3, 9], Pattern recognition [9-11] and Intuition [9]. In hypothetico-deductive reasoning hypothesis is generated based on data from the patient, which is then tested, and further hypotheses are generated to confirm or refute the hypotheses. Use to solve unfamiliar problem or a complex presentation [10]. Decision analysis make patient preferences available as input for clinical decision- making [2, 3]. Von Neumann and Morgenstern first proposed that values and attitudes that drive individual reasoning choice could be understood through mathematical formulations [3]. Later, Ledley & Lusted use decision analysis to show how the concepts of mathematical

<https://assignbuster.com/difficulties-of-medical-decision-making/>

disciplines – symbolic logic and probability can contribute to our understanding of the reasoning foundations of medical diagnosis [1, 3]. Pattern recognition is an inductive reasoning, the current patient's problems are associated with previously-seen clinical problems and a previously-successful treatment is adopted, used by expert and experienced practitioners, tends to be faster and more efficient [10]. Intuition is not recognized as a source of scientific knowledge in clinical reasoning [9]. Heuristics and experiential knowledge use to process large amount of information efficiently Thompson & Dowding. 2002) are important but not a sufficient basis for medical decision making, tend to introduce series of biases into decisions making. [12].

A unifying framework that considers all the different clinical reasoning theories is that of Buckingham and Adams [13], clinical decision making is interpreted as a classification behavior. They argued that hypotheses become classes, the evidence for which consists of their descriptive attributes or features. Linking cues with diagnostic categories, usually regarded as pattern recognition is the same process as connecting evidence with hypothesis in the sense that it is a form of classification activity.

Figure2: Adapted from[14].

Part of the aim of this work to support clinical decision making using data mining and knowledge discovery, incorporating ideas proposed by and Adams [14] to reflect the interaction between normative, descriptive theories of decision making that is the identification of the discrepancies between

real (descriptive) and idealised (normative) behaviour in decision making in order to help people make better decisions through prescriptive support.

[1] R. S. Ledley and L. B. Lusted, “ Reasoning Foundations of Medical Diagnosis,” *Journal of Science*, vol. 130, pp. 9-21, 1959.

[2] A. Round, “ Introduction to clinical reasoning,” *Journal of Evaluation in Clinical Practice*, vol. 7, pp. 109-117, 2001.

[3] P. F. Brennan and I. Strombom, “ Improving health care by understanding patient preferences,” *Journal of the American Medical Informatics Association* vol. 5, May / Jun 1998.

[4] D. Bell, H. Raiffa, and A. Tversky, *Decision making Descriptive, normative and prescriptive interactions*. Cambridge, Cambridge University Press, 1988.

[5]. S. French, “ An introduction to decision theory and prescriptive decision analysis,” *IMA Journal of Management Mathematics*, vol. 6, pp. 239-247, January 1, 1995 1995.

[6] H. Raiffa, “ The prescriptive orientation of decision making: a synthesis of decision analysis, behavioral decision making, and game theory,” in *Decision Theory and Decision Analysis: Trends and Challenges*, S. Ríos, Ed. Massachusetts, USA: Kluwer Academic Publisher, 1994.

[7] C. Thompson, “ A conceptual treadmill: the need for ‘ middle ground’ in clinical decision making theory in nursing,” *Journal of Advanced Nursing*, vol. 30, pp. 1222-1229, 1999.

[8] J. Higgs and M. A. Jones, “ Clinical decision making and multiple problem space,” in *Clinical reasoning in the health professions 3rd edition*, J. Higgs, M. A. Jones, S. Loftus, and N. Christensen, Eds. London: Butterworth-Heinemann Ltd., 2008, pp. 4-9.

[9] M. Offredy, “ The application of decision making concepts by nurse practitioners in general practice,” *Journal of Advanced Nursing*, vol. 28, pp. 988-1000, 1998.

[10] I. Edwards, M. Jones, J. Carr, A. Braunack-Mayer, and G. M. Jensen, “ Clinical Reasoning Strategies in Physical Therapy,” *Physical Therapy*, vol. 84, pp. 312-330, April 2004.

[11] A. S. Elstein and A. Schwarz, “ Clinical problem solving and diagnostic decision making: selective review of the cognitive literature,” *BMJ*, vol. 324, pp. 729-732, March 23, 2002.

[12] C. Thompson, “ Clinical experience as evidence in evidence based practice,” *Journal of Advanced Nursing*, vol. 43, pp. 230-237, 2003.

[13] C. D. Buckingham and A. Adams, “ Classifying clinical decision making: a unifying approach,” *Journal of Advanced Nursing*, vol. 32, pp. 981-989, 2000.

[14] C. D. Buckingham and A. Adams, “ Classifying clinical decision making: interpreting nursing intuition, heuristics and medical diagnosis,” *Journal of Advanced Nursing*, vol. 32, pp. 990-998, 2000.