

The Application of Human Judgment and Statistical Judgment in Medical Decision-Making and the Analysis of the Reasons for the Deviation of Human Judgment

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ABSTRACT

Human judgment and statistical judgment are the most commonly used judgment methods in life. Rational use can effectively help people improve work efficiency and accuracy. This paper is devoted to studying the advantages and disadvantages of these two judgment methods in the medical field. Only when people have a clear understanding of the judgment method can they correctly choose the judgment method. This paper mainly selects literature analysis, theoretical analysis, case analysis and similar comparison to show the characteristics of the two judgment methods. It is preliminarily found that there are some deficiencies in both manual judgment and statistical judgment, and it is difficult to completely overcome them in the context of big data at this stage. However, they help each other, and reasonable interactive use can minimize the judgment error in medical decision-making.

Keywords: *Human Judgment, Statistical Judgment, Rosenthal Effect, Medical Decision-Making*

1. INTRODUCTION

Human judgment and statistical judgment are two commonly used decision-making means in today's society. Many professional authors focus on studying the advantages and disadvantages of these two decision-making methods respectively and use the other option as a tool to contrast or contrast. Historically, the former existed for a long time, while the latter gradually became feasible with the development of science and technology. In theory, the emergence of new things often means that the old things will be replaced, but human judgment can still be seen everywhere in people's lives. After a detailed and in-depth understanding of the characteristics of individual decision-making means, a more important step is to find a delicate balance between the two to maximize their respective effectiveness. This paper mainly discusses the application of human judgment and statistical judgment in the decision-making scene in the medical field. In the research process, the method of case analysis is mainly used to specifically explore the reasons for the deviation of manual judgment in the decision-making scene in the medical field. At the same time, this paper also deeply analyzes the advantages of artificial

judgment in medical decision-making. When the gap between the two decision-making methods is broken, it can maximize the benefits and minimize the losses in the minds of researchers and users at the same time.

2. INTRODUCTION OF HUMAN JUDGMENT AND STATISTICAL JUDGMENT IN THE MEDICAL FIELD

2.1. The Definition of Human Judgment and Statistical Judgment

Human judgment is the process that judges make judgments based on past experience and subjective cognition. Judges can take relevant similar cases into account and use mathematical algorithms to dissect the data; However, the judge needs to consider the problems reflected by the data and give the weight of different factors in the current application cases.

Statistical judgment is based on a large number of case analyses and data analyses. Researchers use computers to edit relevant programs, and then count and analyze the recorded data of all relevant cases. The analysis objects include but are not limited to the

correlation coefficient and influence weight between the data and the experimental results. During the analysis, the researchers did not interfere with the operation of the program. The final judge only calculates the advantages and disadvantages of the judgment results based on the statistical data.

2.2. Practical Use of Human Judgment and Statistical Judgment in the Medical Field

In the past few hundred years, in the process of medical treatment, authoritative diagnosis usually comes from doctors and physicians. For ordinary people, their cognition of the disease is all based on the inquiry and judgment of these doctors, detailed to the time and method of medication, and abstract to the possible survival time of critically ill patients. In the long run, based on countless cases of recovery in history, the role of the doctor has gradually been shaped into a synonym for reliability and professionalism. The way of doctors' consultation has undergone fundamental changes from ancient times to now. The earliest doctors could only rely on their oral empiricism, and the only reference factors were the symptoms and observable physiological reactions described by the patients themselves. With the development of science and technology, the process of diagnosis has become more and more specific and digital.

Patients can usually get their body-related data and relevant reference data after having their blood tested or other examinations. On this basis, the patients themselves can basically see what data abnormalities the physical discomfort comes from. However, the root of tracing the doctor's inquiry is still human judgment, in which doctors use their experience accumulated in decades of learning and practice to make judgments and suggestions on the patient's condition, and the detected data cannot convey more information. At present, most common medical processes have not been able to make a clear division of the severity of patients: for example, which patients need to stop working, which patients can live a normal life, and which patients should enjoy their best life. Therefore, most of the errors of human judgment occur in the process of doctors' analysis of the data reflected by the patient's body.

3. REASONS CONDUCTED BY CASE ANALYSIS FOR DEVIATION OF HUMAN JUDGMENT IN THE MEDICAL FIELD

There are three main reasons for the huge deviation of humans. Ramon defined three differences in her research as the reasons for the deviation of human judgment.

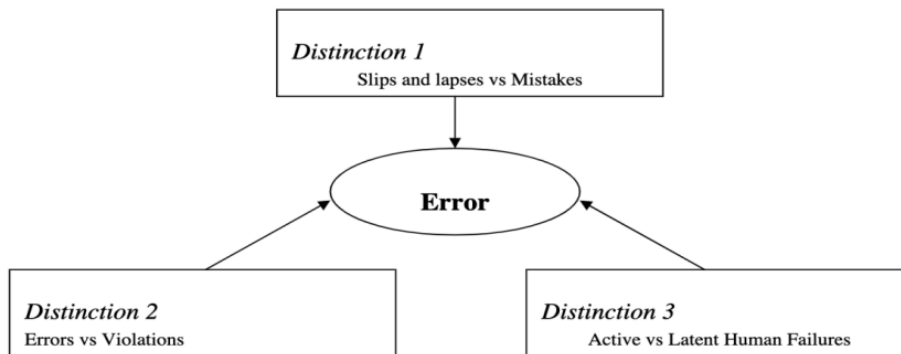


Figure 1 Distinctions of possible reasons [1]

3.1. Lack of Ability

In the following case, one of the reasons is that junior doctors themselves have no ability to make correct judgments, which correspond to failures.

A group of experts asked senior doctors and junior doctors in urology and oncology to predict the life expectancy of patients, and then studied the accuracy of the data and the consistency of the predictions given by various doctors [2].

The results show that junior doctors are less accurate than senior doctors; This is in line with the principle of human judgment, that is, experience and authority can help doctors make more accurate judgments. When the

18 doctors as a whole, under the premise that the experts set a certain allowable error, the result is not ideal: the average underestimation rate is 33.2%, and the frequency of overestimation is much lower, only 3.9%.

It can be seen that if it is not for the particularity of Urology and Oncology, doctors are not optimistic about the accuracy of predicting the remaining survival time of patients, and they usually tend to underestimate the expected survival time of patients. This deviation not only affects the authority of doctors themselves but also makes treatment more difficult. The negative predictions will affect the patient's mood and cooperation with the doctor.

3.2. Active Human Failure Caused by the Particularity of Doctor's Job Profession

The particularity of the profession of doctors is that they will affect the survival of patients to a certain extent, and there are endless conflicts between doctors and patients in today's society; Based on these unique effects, doctors may subjectively make some conservative predictions. This corresponds to the active human failures mentioned by Ramon. This decision-making of doctors is related to the negative effect of the Rosenthal Effect[3]. In the "Rosenthal Effect", the students whose ability has been affirmed by educators have more and more confidence in themselves, and finally have achieved significant improvement in their grades. Correspondingly, the negative effect shows that when people's final harvest results are very different from expectations, they will have a stronger sense of loss in development; And the better the commitment, the more intense the emotion. Human judgment is easily affected by people's subjective emotions and worries. In terms of doctors' prediction of patients' life expectancy, deliberately making negative predictions can reduce the optimism of patients and their families for the future to a certain extent. From a humanitarian point of view, deliberately suppressing the expectations of patients will lead to the deterioration of the patient's mental condition, the inability to correctly cooperate with treatment, and even the decision of family members and patients to stop spending money on treatment. However, from the perspective of doctors, this behavior is immoral but understandable: reducing the expectations of patients can avoid the gap between patients and their families when misfortunes occur, so as to protect the authority of doctors and their own safety; If you are lucky, the patient gets a better result than expected, and others will only attribute the credit to the excellent medical skill of the doctor; Therefore, no matter what the result is, subjectively depressing the expectations of patients and others will benefit doctors without harming themselves and also without being explored.

3.3. Contradicted Human Judgment by Empiricism

There is a defect in the ability of human beings to judge the interferences in the discharge hall. This leads to more frequent errors in manual judgment, which is unconscious. Oncologists were once again asked to predict the survival time of patients with the same disease, and this time they were asked to list the reasons for making different predictions.

The age of the selected patients ranged from 10 to 70, and almost everyone seized on this characteristic and tended to make less optimistic predictions for older people. Doctors have explained that older people have weaker immunity, slower metabolism and less tolerance

than young people. These explanations sound highly reasonable and even common sense. However, when the researchers used statistical methods to analyze the cases recorded in the past 30 years, the results showed that there was little relationship between the follow-up lifetime and age.

The reason for the surprising result needs more research, but it confirms that humans are much more affected by misleading factors than statistics. People are vulnerable to empiricism. For example, the elderly in medical experiments are more vulnerable to irreversible damage, and psychologists default that young children will not react against their true feelings when studying the reactions of infants and young children. These are the "conditions" or "basis" that people subjectively give experiments based on their cognition of the world and biological principles from the human perspective. But in fact, this behavior corresponds to the selection failure listed by Ramon.

4. ANALYSIS OF THE ADVANTAGES OF HUMAN JUDGMENT LEADING OTHER DECISION-MAKING STRATEGIES IN THE FIELD OF MEDICINE

In contrast, human nature exists in the relationship between doctors and patients, not only leading to bad effects. In addition to human nature, it will lead doctors to make some selfish behaviors. In more cases, doctors' sense of responsibility and empathy will urge them to find ways to help patients recover. In the HIMCM mathematical modeling competition in 2020[4], there is such a topic: if the funds used to protect biodiversity are limited, how should environmentalists allocate them to maximize the results. The results obtained in all statistical judgments are based on unshakable premises, such as limited time, energy, capital or manpower. When the feasibility of an event is less than a specific value, the statistics will not hesitate to announce a cold fact: the probability of success of the event is too small, the rate of return is too low, or the risk is too high. In order to maximize the benefits, it is suggested to invest resources in other issues. Indeed, when protecting animals, if the same efforts can help more animals, it is a better choice.

But when this happens in hospitals, when a doctor stands in front of a patient full of longing for life, this cold interest supremacy will no longer be feasible. One of the reasons why human beings can jump out of the range of animals is that human beings have feelings. In normal judgments, subjective feelings lead to errors. But in hospitals, for people with a terminal illness, what can save them is not data, but persistence. A person with warm feelings in his heart can create miracles. In China, there have been consecutive cases of the sudden death of medical staff in recent years, including doctors, anesthesiologists and famous professors [5]. Doctors and nurses in the emergency department have a higher

probability of being exposed to the threat of sudden death [6].

5. POSITIVE ROLE OF HUMAN CARE IN THE MEDICAL PROCESS

Human judgment has a feature that statistical judgment cannot have: real-time communication and comfort in mental state. There are often obstacles in the communication between doctors and patients, possibly because patients can't accept sudden bad luck. When doctors determine the existence of potential obstacles, they can use standard clinical reasoning techniques to trace the root causes of patients' resistance. Effective discovery and resolution of barriers can help doctors win the trust of patients and establish a close relationship with them.

In the process of treatment, doctors and other "human factors" are important links to connect patients and scientific treatment. Their words, attitudes and behaviors may help the treatment process. The qualities of the patient-provider relationship, like empathy and understanding, can also produce measurable physiological improvements beyond the effects of actual treatment by boosting patient expectations, lowering anxiety, increasing psychological support, and improving patient mood [7]. In the process of treatment, it is never just the fight between drugs and viruses in the patient's body. Different psychological states of patients will have a certain, positive or negative impact on the treatment effect.

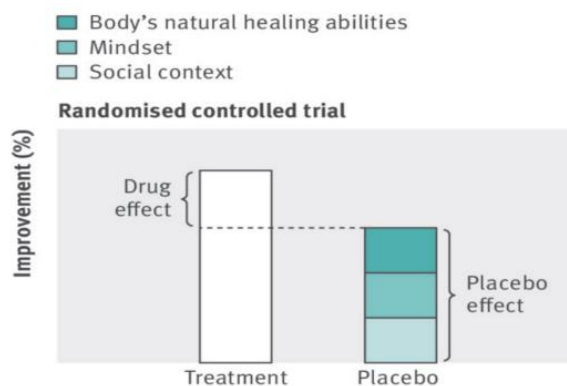


Figure 2 Comparison of therapeutic effects of two methods[7]

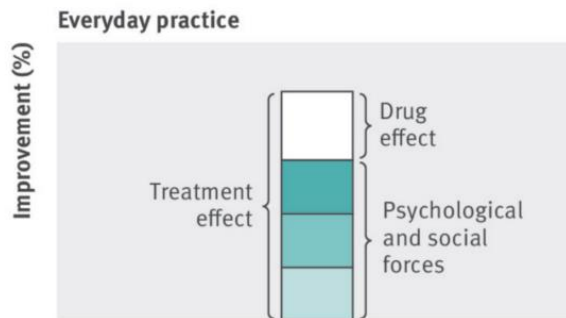


Figure 3 Superimposed medical effects of psychological and practical treatments[7]

The situation in Figure 2 is that at the theoretical level, people usually compare the achievements produced by actual drug treatment and psychological factors. The effect of mental state is usually not as good as drug treatment. Just as the strongest prayers and beliefs can't help cure a person's terminal illness. However, in the practical application in the medical field, the psychological influencing factor is usually the auxiliary effect of professional drug treatment (Figure 3). The interaction between the two is cumulative, which can maximize the effect of the drug and minimize the possible adverse conditions in the treatment process: such as the

patient's refusal to cooperate with the treatment, the unstable values of various physical indicators caused by emotional fluctuations, etc.

6. CONCLUSION

Both human judgment and statistical judgment occupy a certain position in various studies. Although there are similarities between the two, they cannot completely overlap. The advantages of statistical judgment are self-evident: Objective weighing without personal emotion, rapid statistical analysis of similar cases for decades, and stable decision-making results. At

the same time, the human judgment also has many irreplaceable advantages. Although personal emotion will lead to wrong judgment in most cases, it can sometimes guide people to make decisions more in line with human nature; When people have enough confidence and courage to challenge statistics, innovation and breakthrough can occur; In addition, most issues in real life inevitably involve the communication between people. Referring to a certain human judgment can make the statistical judgment more humanized on the basis of accuracy and correctness. This paper can make the argument more intuitive and authoritative through more relevant investigation and research. When studying the characteristics of decision-making in the medical field, people should take different causes of different severity and incidence rate into account under optimal circumstances. Suppose mild colds and fatal cancers will cause different reactions between doctors and patients. Future research should also focus on the characteristics of human judgmental and statistical judgmental application in other fields, such as how prisoners serving sentences in prisons are evaluated by statistical judgmental, and how the subjective human judgmental of upper supervisors affect their evaluation of prisoners' performance. Human judgment and statistical judgment are ubiquitous in real life. The emerging statistical judgment based on high-tech data analysis technology should be introduced into more undeveloped fields. How to retain and optimize human judgment in various fields needs to be understood by more people.

REFERENCES

- [1] Ramon Shaban, Claire Wyatt-Smith, Joy Cumming. Uncertainty, Error and Risk in Human Clinical Judgment: Introductory Theoretical Frameworks in Paramedic Practice 2 February 2004, <https://ajp.paramedics.org/index.php/ajp/article/view/263>
- [2] James R.M. Wilson, Michael G. Clarke, Paul Ewings, John D. Graham, Ruairaidh MacDonagh. The assessment of patient life-expectancy: how accurate are urologists and oncologists? 24 March 2005, <https://bjui-journals.onlinelibrary.wiley.com/doi/abs/10.1111/j.1464-410X.2005.05403.x>
- [3] Defined by Robert Rosenthal (1933–), U.S. psychologist. <https://dictionary.apa.org/rosenthal-effect>
- [4] High School Mathematical Contest In Modeling 2020 Question A, <https://www.mathmodels.org/Problems/2020/HIMCM-B/index.html>
- [5] Minwei Huang, Jiang Liu, Xiuchun Yu. Sudden death: A growing threat to doctors in China. 2 February 2016, [https://www.internationaljournalofcardiology.com/article/S0167-5273\(16\)30220-0/fulltext](https://www.internationaljournalofcardiology.com/article/S0167-5273(16)30220-0/fulltext)
- [6] Sonya health, mark Tyrrell. Stress in emergency departments: experiences of nurses and doctors. 31 April 2019, <https://journals.rcni.com/emergency-nurse/stress-in-emergency-departments-experiences-of-nurses-and-doctors-en2011.07.19.4.31.c8611>
- [7] Alia J Crum assistant professor of psychology, Kari A Leibowitz doctoral candidate, Abraham Verghese professor of medicine, Stanford University, Stanford, CA, USA. BMJ 2017;356:j674. 15 February 2017. <https://www.bmj.com/content/356/bmj.j674.abstract>