Understanding Patient Attitudes Towards the Use of AI in Medical Diagnosis Using Necessary Conditions Analysis

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Abstract: The recent years have brought a rapid growth in the use of artificial intelligence (AI), particularly in medical applications. One of the areas where AI can find application is in medical diagnostics. AI has the potential to revolutionize the field of medical diagnostics by improving the predictive accuracy, speed and efficiency of the diagnostic process. The literature provides many studies on the applications of AI in medical diagnostics, including the attitudes of medical personnel towards this technology. However, few studies focus on evaluating the use of AI in medicine from the perspective of consumers. The article concerns the issue of using artificial intelligence in medical diagnostics. The authors analyse the attitudes of potential patients towards medical applications of AI. They examine the factors determining social acceptance of AI usage in medical diagnostics. They use a new research method based on necessity logic - Necessary Condition Analysis (NCA).

Keywords: AI, Medical diagnostics, Trust to AI, NCA

1. Introduction

Acceptance of artificial intelligence (AI) applications in medical diagnostics is crucial for the future of healthcare. Despite some concerns and challenges, AI has the potential to transform the way we diagnose and treat diseases by improving diagnostic accuracy, reducing waiting times for test results, and increasing access to healthcare (Rawat et al., 2023).

Understanding patient preferences, addressing concerns, and highlighting the benefits of artificial intelligence in diagnostics are crucial for the successful integration of AI technology in healthcare.

Positive attitudes and social trust are essential for the widespread adoption of AI in medical diagnostics (Kumar et al., 2023).

Incorporating trust-building measures, data categorization guidelines, and risk level assessments can further enhance the effectiveness of AI solutions in medical diagnostics (Wolff et al., 2021).

2. Research Methods and Results

The authors of the article designed and conducted a survey study among a group of 1063 adult respondents in Poland in June 2023.

Based on the survey statements, the following research hypotheses, which are necessity hypotheses, were formulated:

Main Hypothesis (H1): Patients' belief that AI will improve healthcare is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Sub-Hypotheses:

Ha: Patients' belief that AI will improve the quality (accuracy) of medical diagnoses is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Hb: Patients' belief that AI will improve the relationship between patients and doctors is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Hc: Patients' belief that AI will improve the accuracy and appropriateness of selected treatment methods is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Hd: Patients' belief that AI will improve their health condition is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

To verify the hypotheses, Necessary Condition Analysis (NCA) (Dul, 2024) was applied. NCA identifies conditions that must be met for a specific outcome (effect, result) to occur. Individual necessary conditions act as bottlenecks to achieving the outcome. If such a condition is not met, achieving the outcome is impossible, as it cannot be compensated for by the presence of other factors. However, meeting the necessary condition does not guarantee success, meaning that a necessary condition is not always sufficient.

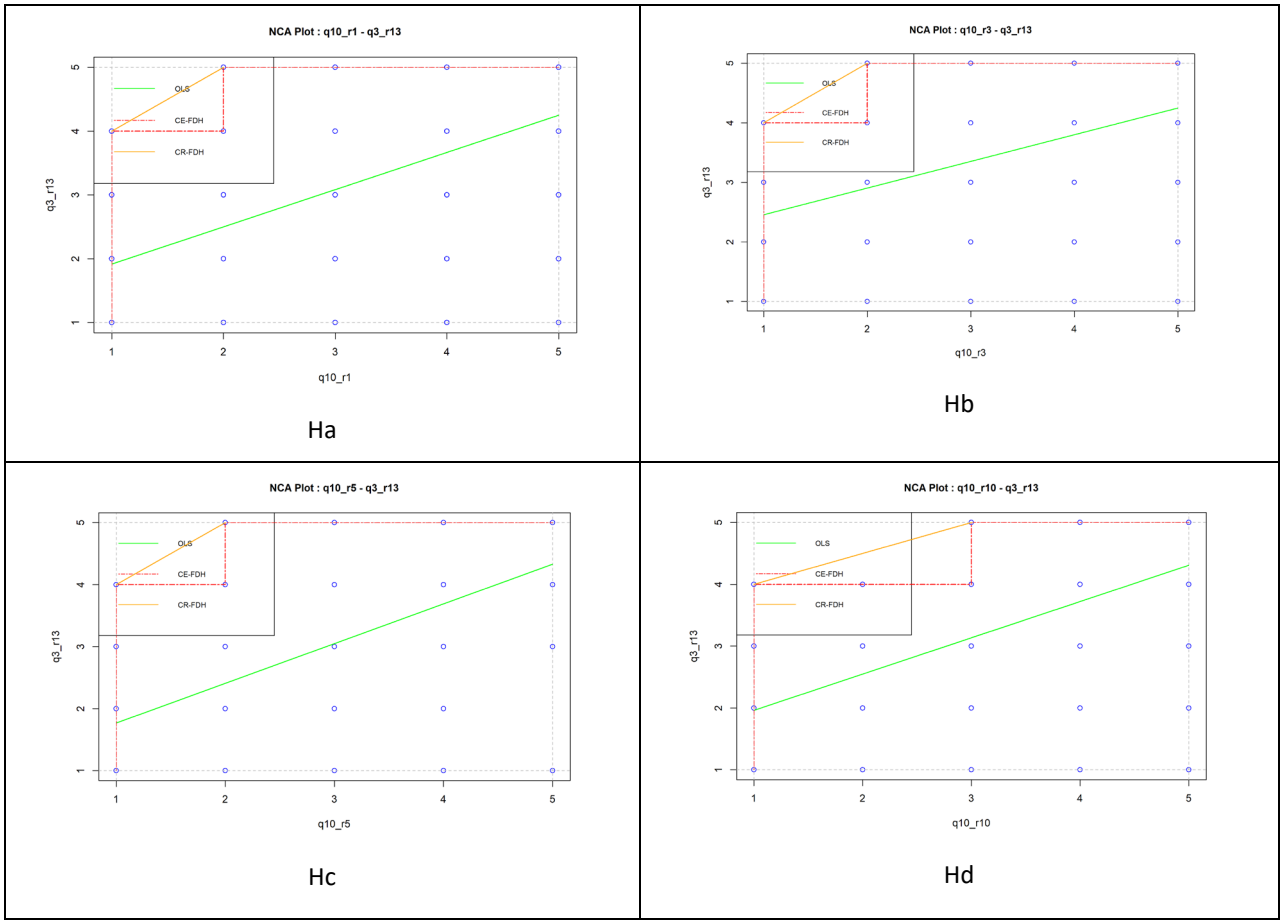
Table 1 presents the effect size of the necessary condition for the formulated sub-hypotheses.

Table 1: Effect size of the necessary condition for the formulated sub-hypotheses (determined using the CE-FDH method)

Hypothesis	The value of the necessary condition effect
Ha	0.06
Hb	0.06
Hc	0.06
Hd	0.12

Source: Own study on the basis of conducted research

For the hypotheses, a ceiling line was presented (Fig. 1).



Source: Own study on the basis of conducted research

Figure 1. Ceiling lines determined by the CE-FDH method for research hypotheses

The obtained results can be interpreted as follows: the most powerful necessary condition for building trust in the medical applications of AI is the patient's belief that AI will improve the patient's health status. As for the other factors, necessary conditions of lesser strength include the patient's belief that AI will improve the quality (accuracy) of medical diagnoses, improve patient-doctor relationships, and enhance the accuracy and effectiveness of selected treatment methods.

Additional information is provided by the constraint analysis (Table 2), built on the basis of the determined ceiling line.

Table 2: Required minimum levels of necessary conditions for various desired levels of achieved outcomes

The response variable (trust in AI as a tool in diagnostic and therapeutic processes) as a percentage of the observed values range		0	10	20	30	40	50	60	70	80	90	100
Explanatory variables, as % of the range of observed values	a	NN	NN	NN	NN	NN	NN	NN	NN	25	25	25
	b	NN	NN	NN	NN	NN	NN	NN	NN	25	25	25
	c	NN	NN	NN	NN	NN	NN	NN	NN	25	25	25
	d	NN	NN	NN	NN	NN	NN	NN	NN	50	50	50
NN – Not Necessary												

Source: Own study on the basis of conducted research

The results from Table 2 indicate that the necessary condition for patients to trust medical AI applications is:

- patients' belief that AI will improve the quality (accuracy) of medical diagnoses at a level of 25%,
- patients' belief that AI will improve the patient-doctor relationship at a level of 25%,
- patients' belief that AI will improve the accuracy and effectiveness of selected treatment methods at a level of 25%,
- patients' belief that AI will improve the patient's health status at a level of 50% of the adopted research scale.

3. Conclusion

The aim of the conducted research was to identify the necessary conditions for building trust in AI as a tool in diagnostic and therapeutic processes. Four potential factors were examined as necessary conditions for such behaviour among patients (hypotheses Ha-Hd).

The results obtained showed that a high level of trust in AI for diagnosis or treatment is conditioned by the patient's belief that AI will improve the quality of diagnoses, the relationship between the patient and the doctor, the accuracy and effectiveness of selected treatment methods, and above all, the patient's health status. This means that in order to build trust in AI among patients, it is crucial to focus on raising awareness among patients about the benefits of medical AI applications mentioned above, as they constitute necessary conditions.

The value of the research conducted is the use of a relatively new method (NCA) that can be useful for analysing issues concerning the identification of the necessary factors that determine certain human behaviours (in this case, acceptance of AI).

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