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Artificial Intelligence and Discretion in Street-Level Bureaucrats: Evidence from Public Healthcare

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Abstract

The adoption of artificial intelligence (AI) has improved the efficiency and quality of public services, but also reshaped discretion in public service delivery. Therefore, it is important to examine how AI adoption influences the discretion of street-level bureaucrats. Drawing on a socio-technical systems perspective within a public healthcare context, we investigate how AI adoption influences physicians' perceived discretion through the interaction of the nature of AI, the behavior of physicians, the attitude of patients, and the organizational environment. Using fuzzy-set Qualitative Comparative Analysis (fsQCA) across 22 departments in the Shandong Provincial Hospital Group, we identify three paths through which discretion is reshaped by adopting AI: (1) the high physician-engagement enforcing path, (2) the high patient-expectation curtailing path, and (3) the high AI-risk curtailing path. Furthermore, our findings show that the effect of AI adoption varies across healthcare contexts, such as between different departments in public hospitals. Our findings offer both theoretical contributions and practical insights into how AI and its social context interact to influence discretion in the public sector.

Keywords

Healthcare artificial intelligence adoption; Street-level bureaucrats; Discretion; Socio-technical systems perspective; fsQCA; Public healthcare

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1. Introduction

The adoption of artificial intelligence (AI) is transforming decision-making processes in public service. In healthcare, AI-based clinical decision support systems (AI-CDSS) are increasingly deployed to enhance diagnostic accuracy, timeliness, and efficiency (Ouanes and Farhah, 2024). While such innovations promise gains in street-level practice, they also introduce profound changes to traditional professional discretion, which is essential for healthcare quality (Henderson, 2013). As AI becomes more embedded in daily routines in healthcare, it raises concerns among physicians regarding the possible curtailing of profession autonomy in healthcare and diminished control over healthcare decision-making processes (Shortliffe and Sepúlveda, 2018).

The complex patient social and economic conditions and the uncertainty of treatment outcomes necessitate considerable discretion for physicians (Bauhr and Carlitz, 2021; Thomann *et al.*, 2018). This aligns with Lipsky's (1980) emphasis on the need for street-level workers to have discretion when navigating the complexities of their work (Lipsky, 1980). In non-routine and high-stakes areas, the exercise of street-level bureaucrats' discretion has been regarded as critical to work implementation (Busuioc, 2021). This is particularly salient in healthcare contexts, where physicians require discretion to interpret complex medical circumstances and patients' personal economic condition, and make informed assessments of potential risks and clinical concerns (Harrits, 2019). The introduction of AI into healthcare thus raises a critical question about how technological innovations may reinforce or curtail discretion in practice.

Previous studies show that information technology (IT) adoption—in particular more recently AI—influences street-level bureaucrats' discretion in two main ways (Alshallaqi, 2024; Bovens and Zouridis, 2002; Vogl *et al.*, 2020). It can either reinforce decision-making (enforcing effect) (Jorna and Wagenaar, 2007; Ranerup and Henriksen, 2022) or limit it (curtailing effect) (Bovens and Zouridis, 2002; Buffat, 2015; Thunman *et al.*, 2020).

Scholars advocating the enforcing effect argue that adopting AI enhances street-level bureaucrats' competence to handle greater complexity and create new and multifaceted forms of discretion (Ball *et al.*, 2023; Bullock, 2019; Thunman *et al.*, 2020; Vogl *et al.*, 2020). However, scholars advocating the curtailing effect believe that increasing digitalization limits or curtails street-level bureaucrats' discretion by partially or completely displacing their decision-making authority (Bovens and Zouridis, 2002; Buffat, 2015; Busch and Henriksen, 2018; De Boer and Raaphorst, 2023), leading to automation bias (Alon-Barkat and Busuioc, 2023) or algorithmic cage (Meijer *et al.*, 2021).

However, scholars increasingly acknowledge that understanding the impact of AI on discretion requires an examination of the organizational and social factors that underpin the AI adoption process (Lombi and Rossero, 2024; Schiff *et al.*, 2025). The existing research offers limited systematic insight into how these contextual factors shape the mechanisms through which AI reconfigures street-level discretion (Alshallaqi, 2024). To address this gap, we focus on public healthcare services and pose the following research question: How do the interactions between technical system and social system influence discretion in public healthcare, either by enforcing or limiting it?

Our study contributes to the existing literature in three aspects. First, we advance understanding of how AI influences street-level discretion by uncovering the interactive mechanisms between the nature of AI, user behavior, client attitudes, and organizational environment. We thus offer new insights into how digital tools impact discretion perception in public service. Second, we offer empirical evidence from street-level practitioners in healthcare and capture the complex and non-linear causal relationship through

which AI adoption in healthcare shapes physician perceived discretion. We move beyond traditional linear or single-cause explanations, highlighting the complex interaction of AI and social context. Third, we extend the socio-technical systems perspective by revealing how technical and social factors interact to influence the perceived discretion within public sector organizations. We enrich the application of the perspective into public sector in the era of AI.

The structure is as follows. Section 2 reviews existing literature and explores the socio-technical systems perspective to AI adoption's impact on physicians' perceived discretion. Section 3 presents the empirical method of our study. Section 4 presents the main results of the empirical analysis. Section 5 discusses our results and findings. The final section concludes key findings and provides theoretical and practical implications, and limitations and future research.

2. Literature Review

2.1. Street-level bureaucrats' discretion in the AI era

Discretion is recognized as a critical coping mechanism for street-level bureaucrats to deal with pressing work circumstances such as heavy workloads, ambiguous policies or difficult clients (Evans and Harris, 2004; Lipsky, 1980; Tummers *et al.*, 2015). It is granted to street-level bureaucrats in order to mitigate the potential negative effects of regulatory measures on citizens (Halling, 2025) and to deliver fair and responsive public services (Pedersen and Pors, 2023). Although the implementation of street-level bureaucrats' discretion carries the risk of becoming a legal pretext for perpetuating social inequalities in cases of abuse (Adams *et al.*, 2021), discretion that is oriented toward public interests and societal needs is considered legitimate and democratic (Rivera and Knox, 2023). Promoting the discretion of street-level bureaucrats to play an active role in practical work requires not only their compassion and kindness (Masood and Nisar, 2022), but also heightens their extra attention to the clients (Tummers and Bekkers, 2014).

The incorporation of AI at the street-level government can improve the policy making process, the public service delivery and internal management of public administrations (van Noordt and Misuraca, 2022), but notably, it may impact street-level bureaucrats' discretion (Moller, 2025). There are two opposing views regarding the impact of IT on street-level bureaucrats' discretion, including reinforcement perspective and curtailment view. The reinforcement view argues that technology may augment the scope of street-level bureaucrats' discretion (Jorna and Wagenaar, 2007). First, although information and communication technologies (ICTs) enable managers to monitor formal actions of street-level bureaucrats and reduce their informational asymmetries, they often fail to regulate informal actions, just obscuring the informal use of discretion (Snellen *et al.*, 2012). Besides, remote supervision via software may compromise the quality of oversight (Jorna and Wagenaar, 2007), leaving actual discretion largely intact. Additionally, more recent AI provides bureaucrats with access to supplementary information and resources to support decision-making (Bullock, 2019). Moreover, attempts to standardize street-level bureaucrats' decision-making procedures sometimes create even more complicated encounters to handle (Thunman *et al.*, 2020) and may redirect the focus of street-level work towards more complex and nuanced case handling (Ball *et al.*, 2023), thereby creating a new form of discretion.

The curtailment view argues that AI exerts curtailing effects on street-level bureaucratic discretion (Bovens and Zouridis, 2002). First, ICTs reshape the dynamics of information exchange between governments and citizens by enhancing citizens' access to information (Cantarelli *et al.*, 2023), thereby weakening street-level bureaucrats' traditional role as information intermediaries and limiting their

discretion (Snellen *et al.*, 2012). Second, in contrast to traditional ICTs, which institutionalize rule-based system-level bureaucracy (Bovens and Zouridis, 2002), the unique machine learning mechanism of AI allows it to operate in a non-deterministic and adaptive fashion, resembling human decision-making (Bullock *et al.*, 2020). As a result, AI not only complements but increasingly replaces street-level bureaucratic judgment, further limiting street-level bureaucratic discretion (Busch and Henriksen, 2018; Wang *et al.*, 2024).

More recently, beyond these two sharply opposing views scholars have increasingly emphasized the complexity of AI's impact on street-level bureaucratic discretion, highlighting its dependence on a range of multidimensional social factors (Alshallaqi, 2024; Buffat, 2015; Bullock, 2019). First, digital technologies shape street-level bureaucrats' discretion through the enabling and curtailing interactions between AI and the users (Alshallaqi, 2024). This underscores the importance of paying closer attention to the end-users of AI. Besides, it's important to incorporate other contextual factors such as the public, intermediary organizations and macro-level policy environments when exploring the relationship between AI and discretion (McKay, 2012; Buffat, 2015; Busch and Henriksen, 2018). Moreover, the characteristics of the tasks handled by street-level bureaucrats are also important. It's suggested that discretion tends to be reinforced in tasks characterized by high complexity and uncertainty, while being readily ceded to AI in routinized or low-complexity tasks (Bullock, 2019). When the task involves a hybrid of traditional street-level, screen-level and system-level work, decision-making remains largely non-automated, but when tasks are only dominated by screen-level and system-level work, automated decision-making diminishes street-level bureaucratic discretion (Moller, 2025).

2.2. *The influencing factors of AI adoption on discretion: A socio-technical systems perspective*

The socio-technical systems perspective (Trist and Bamforth, 1951) proposes that an organization comprises social system and technical system that are some independent but also interrelated. Organizations require joint and integrated optimization of both the technical and social systems, in order to prevent that the technology suppresses human agency, or that human neglect technological practicability due to social resistance or misalignment (Trist and Bamforth, 1951). Otherwise, if the technical system develops excessively quickly without social alignment, it would create functional imbalances in the social system, preventing the organization from functioning effectively (Miao and Yu, 2023). The social system refers to the attributes related to people, interpersonal relations, and power structures, whereas the technical system focuses on processes, tasks, and technologies from input to output (Miao and Yu, 2023; Trist and Bamforth, 1951). The users of technology are part of the social system, and they also shape the practical results of technology through the imbrication of their social agency and technical material agency in the technical system (Leonardi, 2012).

The impact of AI adoption on street-level bureaucrats' discretion can be comprehensively understood through socio-technical systems perspective (Alshallaqi, 2024). Algorithms are not only part of a technological stack, but are framed by forms of knowledge, legalities, governance and institutions (Kitchin, 2017). And the algorithmization based on AI can be interpreted as an emerging technical process in a specific organizational context rather than just the implementation of an instrument (Meijer *et al.*, 2021). Further, the rapid development and application of AI as part of technical system would impact street-level bureaucrats' discretion (part of social system) (Alshallaqi, 2024). The impact was alleged to depend on inherent administrative organization and institution context, an outcome of interplay of technical development and social systems (Beer, 2017).

Physicians are typical street-level bureaucrats, as they engage directly with the community (patients) and serve as street-level providers of public healthcare services (Lipsky, 1980). In their routine practice, under resource constraints, such as limited access to medical equipment and medicines, physicians require the discretion to enable timely, context-sensitive decision-making and ensure that patient needs are met (Hamzah *et al.*, 2019). Physicians exercise this discretion in uncertain and rule-bound situations, and this use of discretion is dependent on client characteristics and professional norms of human services agencies (Henderson, 2013). Drawing on existing literature in the following paragraphs, we summarize in Table 1 the key technical and social factors of AI adoption that would reshape physicians' perceived discretion in public healthcare.

Table 1

The technical and social influencing factors of AI adoption on discretion.

Systems	Factors	Description	References
Technical system	Technical usefulness	<ul style="list-style-type: none"> ● Enhancing diagnostic efficiency and accuracy; ● Reducing workload, and saving time and resources; 	(Yousif <i>et al.</i> , 2024)
	Technical risk visibility	<ul style="list-style-type: none"> ● Transparency of the algorithms; ● Explainability of the algorithms; 	(Busuioc, 2021; Gimmelikhuijsen, 2023)
	Physicians' behavior	<ul style="list-style-type: none"> ● Adopting AI recommendation; 	(Lorenzini <i>et al.</i> , 2023)
Social system	Patients' attitudes	<ul style="list-style-type: none"> ● Client worthiness and needs toward AI; 	(Raaphorst and Walle, 2018)
	Organizational environment	<ul style="list-style-type: none"> ● Organizational basic values, norms; ● Organizational accountability for AI errors. 	(Hupe and Hill, 2007)

2.2.1. The impact of the nature of AI on discretion

AI could reinforce the discretion of street-level bureaucrats (Vogl *et al.*, 2020). In healthcare, proficiency in using AI could not only distinguish the physicians from other clinicians who lack such expertise, but also contribute to the elevation of their professional prestige (Lombi and Rossero, 2024). Physicians expressed the belief that AI would have a significant impact on healthcare, enhance diagnostic efficiency and accuracy in clinical practice, reduce workload, save time and resources (Yousif *et al.*, 2024). This technical practicability strengthens both their professional authority and epistemic capacity, which are essential for exercising informed discretionary judgment (Bullock, 2019).

However, other scholars argue that technical risks can compress the reinforcing benefits of AI (Neumann *et al.*, 2024), making technical risk visibility important for the enforcing effect of AI on discretion. AI relies on algorithms to automate decision-making, and human biases are consciously and unconsciously automated and integrated into the algorithms (Sun, 2021). The technical transparency would help human decision-makers to gain trustworthiness from the public (Gimmelikhuijsen, 2023). Besides, explainability of the algorithmic system is severely necessary to guarantee that humans act as meaningful supervisors of AI (Busuioc, 2021). For AI systems to effectively enhance and augment human intelligence, human actors must first monitor and regulate AI, to mitigate potential risks (Chandra and Feng, 2025). And particularly in healthcare, implementation of algorithms needs to be understood and trusted by physicians, and then explained to the patients, making the transparency and explainability of AI important (Diprose *et al.*, 2020).

2.2.2. *The impact of users' behavior of AI adoption on discretion*

The behaviors of AI adoption vary among different street-level bureaucrats (Alon-Barkat and Busuioc, 2023; Selten *et al.*, 2023). Some street-level bureaucrats, such as police officers on duty, tend to accept AI-generated recommendations that align with their own professional intuition, thereby preserving their autonomy and discretionary authority without direct challenge (Selten *et al.*, 2023). However, research has also found through survey experiments that street-level bureaucrats may automatically default to the algorithm, even to the poor algorithmic advice, leading to automation bias and ceding discretion to AI (Alon-Barkat and Busuioc, 2023).

The concerns about AI adoption have been raised in healthcare (Shortliffe and Sepúlveda, 2018). Physicians sometimes perceive AI as a potential threat to their professional autonomy, fearing a reduction in their control over decision-making processes in healthcare (Shortliffe and Sepúlveda, 2018). It's emphasized that the decision making autonomy in daily practice in healthcare increasingly hinges on physicians' clinical expertise and their capacity to critically evaluate AI recommendations and effectively communicate these evaluations to patients (Lorenzini *et al.*, 2023).

2.2.3. *The impact of clients' attitudes toward AI adoption on discretion*

Client worthiness and needs are central to street-level bureaucrats' decision making, having significant implications for the equity and fairness of the public service delivery (Henderson, 2013). Street-level bureaucrats have been called citizen agents, indicating that their judgement of client needs matter more than the policy and regulation when they balance how to treat clients (van Loon and Jakobsen, 2018). In order to respond to client needs, street-level bureaucrats need to have certain competencies to negotiate with clients (Bruhn and Ekström, 2017). Sometimes, under conditions of resource scarcity, street-level bureaucrats even require to manifest personal emotions and actively cope with client needs to increase clients' well-being (Lavee and Strier, 2019). And responding to client needs is also a way for bureaucrats to avoid frustration and gain satisfaction at work (Nielsen, 2006).

The adoption of AI in healthcare may affect the relationship between physician and patient, and even promote tripartite shared decision-making involving AI, physicians, and patients (Lorenzini *et al.*, 2023). The client attitude towards AI is relevant for successful AI adoption (Neumann *et al.*, 2024). Although citizens tend to choose bureaucrats over AI to make decisions (Gaozhao *et al.*, 2024), physicians need to respect clients' choice when they convey preference for AI decision-making (Abouzahra *et al.*, 2024; Lorenzini *et al.*, 2023). When physicians make decisions after fully considering the clients' curative aspirations and complex needs, the physician's decision-making autonomy is limited (Raaphorst and Walle, 2018).

2.2.4. *The impact of organizational accountability for AI implementation on discretion*

Organizational values, norms, and incentives interact with individual motivation and social identity to indirectly influence individual behavior (Henderson, 2013). Positive organizational factors will lead to street-level bureaucrats' decision-making that maximizes the benefits to clients (Knox and Arshed, 2024). Accountability is part of bureaucratic governance and core organizational factor influencing bureaucrats' discretion (Hupe and Hill, 2007). Street-level bureaucrats are held accountable in different ways and to varying degrees, and bureaucrats constantly weigh how to act within the web of these multiple accountability (Hupe and Hill, 2007).

Successful adoption of AI in the public sector requires close attention to key organizational prerequisites (Schiff *et al.*, 2025), in particular, accountability. The automated decision-making system

based on AI increases bureaucrats’ trade-offs between the adopted decision recommended by AI and the institutional accountability in the public sector (Roehl and Hansen, 2024). In healthcare, physicians’ autonomy has been challenged by various processes such as greater accountability (Bury and Taylor, 2008). Further, in healthcare, reasonable diversification of blame attributing for AI errors could drive physicians to flexibly combine AI recommended solutions with their own knowledge, reinforcing physicians’ perceived discretion (Meijer *et al.*, 2021; Tao *et al.*, 2024).

Based on the above analysis, we construct an analysis framework for the effect of the technical and social factors of AI adoption on physicians’ perceived discretion, as shown in Fig.1. And the effect of four factors of AI adoption (the nature of technology, physicians’ behavior, patients’ attitude, and organizational environment) on physicians’ perceived discretion is summarized in Table 2.

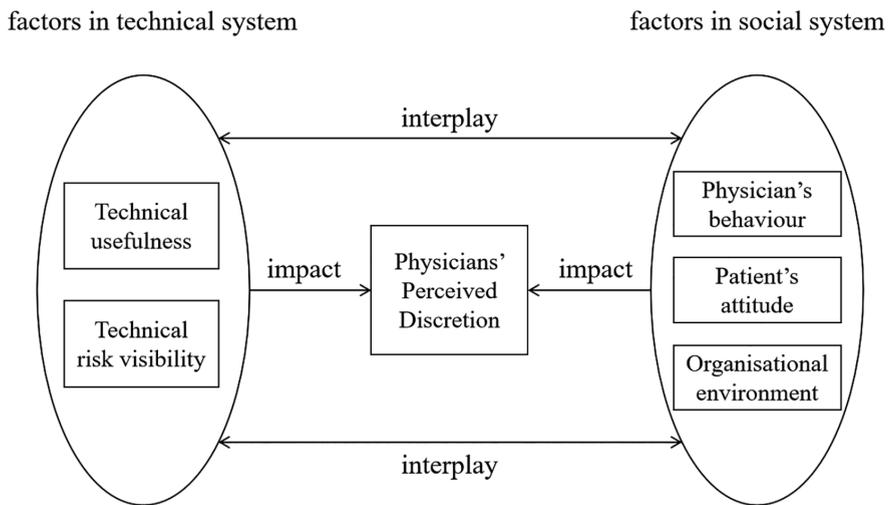


Fig. 1. The impact analysis framework of technical and social factors of AI adoption on discretion.

Table 2

The effect of technical and social factors of AI adoption on discretion.

Factors	Effect of the factor on discretion	References
Technical usefulness	<ul style="list-style-type: none"> ● Reinforce discretion by fostering physicians’ professional prestige; ● Reinforce discretion by enhancing physicians’ professional and epistemic ability of healthcare; 	(Bullock, 2019; Lombi and Rossero, 2024)
Technical risk visibility	<ul style="list-style-type: none"> ● Reinforce discretion by helping physicians gain the trust of patients; ● Reinforce discretion by guaranteeing physicians act as effective supervisors of AI decisions; 	(Busuioc, 2021; Grimmeliikhuijsen, 2023)
Physicians’ behavior	<ul style="list-style-type: none"> ● Reinforce discretion by effectively evaluating AI’s validity and explaining it to patients; ● Limit discretion by defaulting to the poor algorithmic recommendations; ● Unaffected discretion by adopting AI recommendations consistent with their own professional judgment; 	(Alon-Barkat and Busuioc, 2023; Lorenzini <i>et al.</i> , 2023; Selten <i>et al.</i> , 2023)
Patients’ attitudes	<ul style="list-style-type: none"> ● Limit discretion by considering the clients’ curative aspirations and complex needs towards AI; 	(Raaphorst and Walle, 2018)
Organizational environment	<ul style="list-style-type: none"> ● Reinforce discretion by diversifying physician-perceived blame attributing for AI errors. 	(Meijer <i>et al.</i> , 2021)

3. Methods

3.1. The fsQCA method

To investigate the configurable effects of technical and social factors of AI adoption on physicians' perceived discretion, we employ fuzzy-set Qualitative Comparative Analysis (fsQCA). Qualitative Comparative Analysis (QCA) was first proposed by Charles C. Ragin in 1987 (Ragin, 1978), and it is used to identify concurrent, asymmetric, and equivalent configurations of causal conditions for certain outcomes. There are several types of QCA method, including crisp-set QCA, multiple-value QCA and fuzzy-set QCA, applicable to different research contexts (Rihoux and Ragin, 2009).

We employ the fsQCA method for several reasons. First, the fsQCA method could potentially answer our research question well. Technical and social systems are not totally independent of each other, but rather intertwined and interpenetrating. fsQCA is suitable in uncovering the complex interactive mechanisms of such multiple causal conditions. Second, AI could generate either curtailing or enforcing effects on street-level bureaucrats' discretion (Bullock, 2019). Through fsQCA, we could find the probable asymmetric causal configurations for the dual outcome. Third, the condition variables and outcome variable measure the level of perception of physicians, which is a continuous degree. FsQCA allows cases to have continuous membership scores to the variable set, which is consistent with the essential nature of our data (Wang *et al.*, 2024).

3.2. Case selection

We selected 22 departments within the Shandong Provincial Hospital Group as case studies, which have all implemented AI-enabled Clinical Decision Support Systems (AI-CDSS). AI-CDSS represents a prototypical application of AI in healthcare, offering physicians extensive data support and evidence-based recommendations for clinical diagnosis and treatment (Ouanes and Farhah, 2024). The Shandong Provincial Hospital Group has collaborated with the smart healthcare company Dr. Mayson to carry out in-depth initiatives in intelligent path optimization and AI-driven decision support.

To ensure case diversity and comprehensiveness, we sought to include all departments that had adopted AI-CDSS. The cases we ultimately included cover a wide spectrum of professional specialties, including surgery, internal medicine, gynecology, pediatrics, otolaryngology, traditional Chinese medicine, health technology units, and the emergency department. Detailed departmental information is presented in Table 3.

Table 3
Case information.

Case No.	Department name	Department type
1	Infectious Diseases Department	
2	Gastroenterology Department	
3	Oncology Research and Treatment Center	
4	Respiratory and Critical Care Medicine Department	Internal Medicine -
5	Hematology Department	Clinical Department
6	Endocrinology and Metabolism Department	
7	Cardiology Department	
8	Interventional Therapy Department	

Table 3. (continued)

Case No.	Department name	Department type
9	Orthopedic Department (Trauma Orthopedics, Joint Surgery, Spinal Surgery)	
10	General Surgery Department (Gastrointestinal Surgery, Hepatobiliary Surgery)	
11	Urology Department	Surgery - Clinical Department
12	Thoracic Surgery Department	
13	Vascular Surgery Department	
14	Cardiac Surgery Department	
15	Ophthalmology Department	
16	Gynecology Department	Obstetrics and Gynecology, Pediatrics, Ophthalmology, and Traditional Chinese Medicine System - Clinical Department
17	Stomatology Department	
18	Pediatric Surgery Department	
19	Traditional Chinese Medicine Department	
20	Pathology Department	Auxiliary Medical System - Operational Department
21	Ultrasound Medicine Department	
22	Emergency Department	-

3.3. Data and calibration

To apply the fsQCA method in analyzing how technical and social conditions jointly shape physicians' perceived discretion, we conducted a questionnaire survey targeting clinical physicians across all selected departments to collect data. The questionnaire captured information on departmental characteristics, physician demographics, the technical attributes of AI-CDSS, physicians' usage behaviors, perceived patient attitudes, and organizational context. Following the initial development of the questionnaire, a pilot test was conducted with 10 physicians experienced in the use of healthcare AI. Based on their feedback, the questionnaire was revised to improve its clarity and comprehensibility. During the formal survey phase, in each department, 10 to 15 physicians were randomly selected to participate and finally a total of 278 questionnaires were distributed, yielding a response rate of 17.26%. Of the returned responses, 92.31% were deemed valid, with invalid responses primarily excluded due to incomplete answers or patterned response behaviors. Detailed sample characteristics are presented in Table 4.

Table 4

Sample information.

Variable	Value	Number (person)	Percentage
Gender	Male	33	68.75%
	Female	15	31.25%
Age (years old)	25-34	2	4.17%
	35-44	30	62.50%
	45-54	15	31.25%
	55-59	1	2.08%

Table 4. (continued)

Variable	Value	Number (person)	Percentage
Years of work experience	1-10	13	27.08%
	11-20	24	50%
	21-30	9	18.75%
	Above 30	2	4.17%
Administrative position	No administrative position	38	79.17%
	Department head or Deputy head	9	18.75%
	President or Vice president	1	2.08%
Professional title	Attending physician	10	20.83%
	Associate chief physician	22	45.83%
	Chief physician	16	33.33%

For the fsQCA analysis, each causal conditions and outcome were operationalized using several questionnaire items to ensure the validity of the measurements. Physicians' perceived discretion, technical usefulness, technical low-risk, physicians' behavior and patients' attitude were all measured through a 7-point Likert scale (Callens, 2023). The organizational environment employed multiple-choice questions. Detailed information on the survey content is shown in Table 5.

First, physicians' perceived discretion was operationalized as their perceived autonomy in clinical diagnostic and treatment decision-making (Bauhr and Carlitz, 2021). Second, technical usefulness was measured by the accuracy of the recommended diagnostic decision, the effectiveness of the recommended treatment decision, and the extent to which AI-CDSS reduced physicians' workload (Yousif *et al.*, 2024). Third, technical low-risk was assessed via the transparency and interpretability of the system's rules and algorithms (Chandra and Feng, 2025). Forth, physicians' behavior consists of the frequency of AI-CDSS use, the degree of adoption of AI-CDSS generated recommendations (Lorenzini *et al.*, 2023), and physicians' willingness to recommend the system to colleagues. Fifth, patients' attitude was evaluated via physicians' perceptions of patient trust in AI-CDSS and patients' expectations regarding the adoption of such system recommendation (Raaphorst and Walle, 2018). Finally, Organizational Environment was measured by physicians' perceptions of how responsibility for clinical outcomes involving AI-CDSS (Meijer *et al.*, 2021) was distributed across multiple stakeholders, including hospitals, the design and development companies of AI-CDSS, and the distributors of AI-CDSS.

Table 5

Questionnaire items.

	Variable	Item	Reference
Outcome Variable	Physicians' Perceived Discretion(PPD)	● Physicians' perceived discretion in healthcare treatment decision-making;	(Bauhr and Carlitz, 2021)
	Technical Usefulness (TU)	● Accuracy of the recommended diagnostic decision;	(Yousif <i>et al.</i> , 2024)
		● Effectiveness of the recommended treatment decisions;	
		● Reduction in physicians' workload;	

Table 5. (continued)

	Variable	Item	Reference
	Technical Risk Visibility (TRV)	<ul style="list-style-type: none"> ● Transparency of rules and algorithms; ● Interpretability of rules and algorithms; 	(Chandra and Feng, 2025)
Causal Variable	Physician's Behaviour (PB)	<ul style="list-style-type: none"> ● Frequency of physicians' use of AI-CDSS; ● Degree of physicians' adoption of AI-CDSS solutions; ● Physicians' willingness to recommend to colleagues; 	(Lorenzini <i>et al.</i> , 2023)
	Patient's Attitude (PA)	<ul style="list-style-type: none"> ● Physicians' perceived patient trust in AI-CDSS; ● Physicians' perceived patient adoption expectation of AI-CDSS solutions; 	(Raaphorst and Walle, 2018)
	Organizational environment (OE)	<ul style="list-style-type: none"> ● Physicians' perceived dispersion of liability arising from AI errors. 	(Meijer <i>et al.</i> , 2021)

To prepare our data for fsQCA, we calibrated the membership scores for each condition and the outcome. In fsQCA, case membership scores for each condition and outcome range from 0 to 1, where 0 indicates full non-membership, 1 indicates full membership. Scores below 0.5 reflect weak membership, and scores above 0.5 indicate strong membership in the set. Since the questionnaire provides descriptive data, indirect calibration (theoretical calibration) is used for multi-value calibration (Callens, 2023). The specific calibration method follows the experiences of previous scholars (Callens, 2023). For the items of the 7-point Likert scale, we set the calibration criterion that score of 5 is the crossover point. For a given variable and a case to be calibrated, if 100% of the answers to the relevant items from the case are greater than 5, the calibrated membership of the case to the variable set is 1. If more than 50% of the answers are greater than 5, the calibration membership is 0.67. If more than 50% of the answers are greater than or equal to 5, the calibration membership is 0.33. If more than 50% of the answers are less than 5, the calibration membership is 0.

For the Organizational Environment, multiple-choice items were used, with each option representing a distinct entity potentially responsible for bearing liability for damages. The indirect calibration criteria for this variable were as follows (Callens, 2023): if fewer than 25% of the options were selected, the membership score was calibrated as 0; if 25% to less than 50% were selected, the score was 0.25; if 50% to less than 75% were selected, the score was 0.501; if 75% to less than 100% were selected, the score was 0.75; and if all options were selected, the score was 1.00. Calibration results are presented in Table 6.

Table 6

Calibration results.

Case No.	Reinforcement of physicians' perceived discretion	High technical usefulness	High technical risk visibility	Active use by physicians	Positive patient attitude	Dispersion of healthcare liability
1	0	0	0	0	0	0.25
2	0.67	0.33	0.67	0.33	0.33	0.25
3	0	0.67	0.33	0	0.33	0.501
4	0.33	0.67	1	0.67	1	0.75

Table 6. (continued)

Case No.	Reinforcement of physicians' perceived discretion	High technical usefulness	High technical risk visibility	Active use by physicians	Positive patient attitude	Dispersion of healthcare liability
5	0.33	0.33	0.67	0.33	0.67	0.75
6	0.67	1	0.67	0.33	0.67	0.75
7	1	0.67	0	0.67	0	1
8	1	0	0	0.33	0	0.75
9	0	0.33	0.33	0	0.33	0.501
10	0	0.33	0.33	0	0.33	0.75
11	0.67	0.67	0.67	0	0.33	0.501
12	0.33	0.33	0	0.33	0.33	0.75
13	0.33	0.33	0.33	0	0	0.25
14	1	0.33	0.33	0	0.33	0.25
15	0	1	1	0.67	1	1
16	0.33	0	0	0	0	0.75
17	0.33	0.33	0.33	0.33	0.33	0.501
18	0	1	1	0.67	1	1
19	0.33	0.33	0.33	0.33	0.33	0.501
20	1	0.33	0.67	0.67	0	0.75
21	0	0.33	0	0	0.33	0.25
22	0.33	1	0.33	0	0.33	0.501

4. Results

We used fsQCA 4.0 software to identify the necessary conditions and sufficient conditions for reinforced and limited discretion perceived by physicians, based on the constructed truth tables and Boolean minimization algorithms.

4.1. Analysis of necessary conditions

Necessary condition analysis results show that none of the causal conditions and their non-sets is the necessary condition for the physicians' perceived reinforced discretion and limited discretion. The consistency levels of all causal conditions and their non-sets are below the threshold value of 0.9. Consequently, a single causal condition cannot effectively explain the outcomes of reinforced or limited discretion perceived by physicians. Detailed results of necessary condition analysis are shown in Table 7.

Table 7

Necessary condition analysis results.

Causal condition/ their non-sets	Reinforced discretion perceived by physicians		Limited discretion perceived by physicians	
	Value of consistency	Percentage of coverage	Value of consistency	Percentage of coverage
TU	0.614	0.515	0.572	0.741
~TU	0.691	0.512	0.625	0.714

Table 7. (continued)

Causal condition/ their non-sets	Reinforced discretion perceived by physicians		Limited discretion perceived by physicians	
	Value of consistency	Percentage of coverage	Value of consistency	Percentage of coverage
TRV	0.577	0.555	0.497	0.739
~TRV	0.728	0.484	0.700	0.719
PB	0.460	0.703	0.299	0.705
~PB	0.807	0.427	0.874	0.714
PA	0.421	0.457	0.522	0.875
~PA	0.884	0.545	0.676	0.643
OE	0.778	0.508	0.718	0.724
~OE	0.577	0.570	0.512	0.781

Note: “~” denotes the non-sets.

4.2. Analysis of sufficient conditions

In the sufficient analysis of both physicians’ perceived discretion reinforcement and curtailment, we set the raw consistency threshold to 0.80 in the fsQCA 4.0 software, the PRI consistency threshold to 0.70, and the frequency threshold to 1.00. Only configurable condition combinations with raw consistency value above 0.80, PRI consistency value above 0.70 and frequency above 1.00 would be the valid paths (Rihoux and Ragin, 2009). The valid paths will be output by the fsQCA 4.0 software, and the applicable cases will also be output.

Results of sufficient condition analysis show there are two paths, **S1a** and **S1b** that lead to reinforced discretion perceived by physicians, and three paths, **NS1a**, **NS1b** and **NS2** that lead to limited discretion perceived by physicians,. As shown in Table 8, each column represents a valid configurable path, and the state of each condition in a path is one of the three states: must be present, must be missing, and either present or missing.

According to the results output by the fsQCA4.0 software, first, for the sufficient analysis of physicians’ perceived discretion reinforcement, the PRI consistency cut-off value is 1.000, indicating that both path **S1a** and path **S1b** would not lead to common cause but different effect phenomenon. The overall consistency value is 1.000, meaning that all eligible cases generate reinforced discretion perceived by physician. The overall coverage percentage is 0.375, suggesting that these two paths explain 37.5% of the reinforced case. Second, for the sufficient analysis of physicians’ perceived discretion curtailment, the PRI consistency cutoff value for is 0.737, indicating that paths **NS1a**, **NS1b** and **NS2** would usually not lead to common cause but different effect phenomenon. The overall consistency value is 0.862, meaning that 86.2% of eligible cases generate limited discretion perceived by physician. The overall coverage percentage is 0.705, suggesting that these three paths explain 70.5% of the curtailed cases.

To assess the validity and robustness of our study, some modifications of data analysis were made to conduct a robustness test. First, when the PRI consistency threshold was progressively increased from 0.70 to 0.75 and 0.80, the valid paths remained unchanged for the sufficient analysis of physicians’ perceived discretion curtailment. Second, when the frequency threshold was raised from 1 to 2, the resulting valid paths did not change for the sufficient analysis of physicians’ perceived discretion reinforcement and also curtailment. Tiny disturbances didn’t alter the substantive interpretation of the research findings, demonstrating the stability of our findings.

Table 8

Sufficient condition analysis results.

Causal condition	Reinforced physicians' perception discretion		Limited physicians' perception discretion		
	S1a	S1b	NS1a	NS1b	NS2
Technical usefulness	●	⊗		●	⊗
Technical risk visibility	⊗	●	●	●	⊗
Physician's behaviour	●	●	⊗		⊗
Patient's attitude	⊗	⊗	●	●	⊗
Organizational environment	●	●	●	●	⊗
Consistency	1.00	1.00	0.885	0.909	0.827
Raw coverage	0.335	0.221	0.341	0.441	0.418
Unique coverage	0.154	0.039	0.025	0.126	0.238
Case No.	7	20	5, 6	4, 6, 15, 18	1, 13, 14, 21
Overall Consistency	1.000		0.862		
Overall coverage	0.375		0.705		

Note: ● indicates the core condition is present; ⊗ indicates the core condition is absent; ● indicates the presence of a marginal condition; ⊗ indicates the absence of a marginal condition; A blank space indicates the condition may either be present or absent (i.e., it is not decisive for the outcome).

4.3. Reinforced discretion perceived by physicians

We name both path **S1a** and path **S1b** as “**the high physician-engagement enforcing**”, marked by physicians' active use behavior of AI and physicians' negative attitudes towards AI in healthcare. According to the results of necessary condition analysis, the core conditions for both paths are active physician use of healthcare AI and negative patient attitudes toward healthcare AI, and the marginal condition is risk diversification supported by the organization. This suggests that when patients do not exert external pressure on physicians and physicians voluntarily choose to actively use AI based on their assessment of the technical usefulness and risk, their perceived discretion expands, very consistent with existing research findings (Lorenzini *et al.*, 2023). Furthermore, we found that technical usefulness and risk visibility are interchangeable under “the high physician-engagement enforcing” paths.

4.3.1. Path S1a: efficiency-driven reinforcement

As shown in S1a path, one of the marginal conditions is high technical usefulness. The perceived discretion of physicians is reinforced through a jointly interaction between high technical usefulness, active physician use, negative patient attitudes, and organizational risk diversification. Specifically, this path is characterized by a configuration in which technical usefulness serves as a marginal but indispensable condition.

This suggests that in contexts where AI in healthcare demonstrates high diagnostic accuracy, treatment efficacy, and workload-reducing potential, physicians are more likely to proactively integrate AI into their decision-making in healthcare. Importantly, this integration is not merely reactive or imposed, but voluntary and strategic. In the absence of external patient pressure and supported by risk-sharing institutional arrangements, physicians could harness the high perceived utility of AI as a resource for efficiency gains, thereby justifying new space of decision making autonomy in healthcare. The

corresponding case in the cardiology department exemplifies this pattern, where the integration of AI-CDSS appears to be driven by its practical value in managing complex diagnostic and treatment routines. Particularly under high patient volumes and performance pressure, AI-CDSS is framed and experienced as an efficiency-enhancing tool rather than a supervisory mechanism.

4.3.2. Path S1b: risk-buffered reinforcement

As shown in path **S1b**, one of the marginal conditions is high technical risk visibility. This path represents a distinct configuration in which physicians' perceived discretion is reinforced through a risk-buffering logic, underpinned by the technical risk visibility and the convergence of organizational dispersed liability and active physician engagement and negative patient attitudes. In this path, the AI system is not necessarily perceived as highly useful, but it is experienced as trustworthy and non-threatening, owing to its algorithmic transparency and explainability and organizationally diffused liability arrangements.

Crucially, this psychologically secure environment facilitates physicians' voluntary and proactive use of AI, not because of performance enhancement (as in **S1a**), but because of reduced worry and risk aversion. In this sense, a more confident and autonomous mode of AI is supported by physicians' psychological safety and trust. The technical high risk visibility, coupled with institutional support, makes AI is deemed less as a control instrument and more as a risk-mitigating co-pilot, enabling physicians to maintain, and even extend, their decision-making discretion. The pathology department case exemplifies this path. Physicians in this context may often operate under high diagnostic uncertainty and legal sensitivity.

4.4. Limited discretion perceived by physicians

4.4.1. Path NS1a and NS1b: "the high patient-expectation curtailment"

We name both path **NS1a** and path **NS1b** as "**the high patient-expectation curtailment**", characterized by positive patient attitudes toward healthcare AI. According to the results of necessary condition analysis, the core condition for both paths is positive patient attitude, and the marginal conditions are high technical visibility and risk diversification supported by the organization. Despite the seemingly favorable technological and institutional environment, physicians' perceived discretion is limited, primarily due to the external expectations and behavioral pressure imposed by patients. Patients' growing acceptance and promotion of AI effectively reconfigures traditional discretion in healthcare. And physicians would perceive part of their discretion transferred to healthcare AI. Interestingly, there are two types of "patient-exerted pressure-curtailment" paths.

NS1a: physician conceded curtailment

As shown in path **NS1a**, one of the marginal conditions is physicians' passive use. Although the technical environment is marked by high risk visibility and institutional support for liability diffusion, physicians demonstrate reluctant or passive AI use, primarily in response to strong patient endorsement of AI-supported decision-making. Unlike the other similar path **NS1b**, on this path **NS1a**, the technical usefulness is low and patients are reluctant to use the technology. This reflects a kind of passive concession driven by the symbolic and behavioral pressure exerted by patients, who are equipped with digital literacy or consumerist healthcare orientations.

This path illustrates a conceded curtailment dynamic, wherein physicians passively comply with AI recommendations under the influence of patient-driven expectations. In this path, physicians report

low use frequency and minimal adoption of AI recommended solutions which exhibit low technical usefulness. However, the strong patient trust in AI and high expectation of AI adoption from patients creates a compelling external normative pressure for physicians to conform. In order to align with patient preferences, physicians may act as implementers of externally favored tools rather than autonomous decision-makers. Physicians' perceived discretion partially conceded to AI. This path is particularly evident in departments such as hematology and endocrinology, where patients may frequently engage with AI-based monitoring tools. Over time, these tools foster a strong user belief.

NS1b: patient delegated curtailment

As shown in path **NS1b**, one of the marginal conditions is technical usefulness. It illustrates a technology-driven, patient-delegated curtailment of physician discretion, shaped by the interaction of positive patient attitudes, low perceived risk, organizational diversified liability and high technical usefulness. Unlike path **NS1a**, where physicians reluctantly concede to external pressure, path **NS1b** configuration reflects a more subtle and tactful form of discretion transfer to AI. In path **NS1b**, there's still pressure from patients, but the discretion is somehow technically rationalized and socially legitimized, since the AI is useful.

This path indicates that the delegation mechanism does not reinforce physicians, but instead reconfigures their professional role. The perceived high usefulness of AI brings accurate diagnostics, efficient treatment suggestions, and tangible workflow support. Simultaneously, positive patient attitudes toward AI reinforce an implicit delegation of authority, whereby patients expect physicians to integrate AI into decision-making. Decision-making in healthcare becomes increasingly structured around AI outputs. Physicians' discretion is incrementally absorbed into a socio-technical systems where AI recommendations acquire default legitimacy. This path is exemplified in departments such as respiratory and critical care medicine, endocrinology and metabolism, ophthalmology, and pediatric surgery, where the high stakes of timely diagnosis and the prevalence of data-intensive monitoring converge. In these contexts, AI use is not perceived as optional, but as a default expectation.

4.4.2. Path NS2: "the high AI-risk curtailing"

We name path **NS2** as "risk imposed curtailment", characterized by dual risk burden perceived by physicians from both AI and the organization. According to the results of necessary condition analysis, its core conditions are low technical risk visibility and undispersed liability by the organization, and marginal conditions are low technical usefulness, physicians' passive use, and patients' negative attitudes. The two core conditions work together to amplify physicians' risk perception. The low technical usefulness fails to enhance the resource and cognitive benefits for physicians, but instead increases decision-making noise.

This path reflects that AI adoption is not only perceived as unhelpful but also as a potential liability, further curtailing discretion through the logic of risk containment. AI is neither perceived as epistemically reliable nor clinically useful. AI is technically low useful and with high risk, and both physicians and patients feel bad about AI. Specifically, without institutional safeguards such as liability sharing or clear accountability frameworks, physicians face the full burden of potential failure, exacerbating their sense of risk exposure. Consequently, physicians retreat into risk-averse and conservative behavior and their self-preservation instincts take precedence over proactive decision-making in healthcare (Lavee and Strier, 2019). This path illustrates how technological fragility, institutional vacuum, and weak physician-AI trust coalesce to limit professional discretion. More cautious decision-making leads physicians to voluntarily

transfer their discretion in favor of industry standards and guidelines. This configuration is observed in departments such as infectious diseases, vascular surgery, cardiac surgery, and ultrasound medicine, where clinical environments may be complex, liability stakes are high, and the tolerance for diagnostic error is particularly low.

5. Discussion

5.1. Substitution effects exist within specific combined conditions

According to our findings, physicians' perceived discretion is reinforced when patients do not exert external pressure on physicians and physicians voluntarily choose to actively use AI, based on their assessment of the technical usefulness and risk, as shown in paths **S1a** and **S1b**. Besides, physicians' perceived curtailment of discretion arises either from external normative pressure from patients, as shown in paths **NS1a** and **NS1b**, or their own conservative decision-making led by perceived technical and organizational risk exposure, as shown in path **NS2**. Path **S1a** and path **S1b** are substitutable, as are path **NS1a** and path **NS2**. The five influencing paths of adopting AI on discretion are shown in Fig.2.

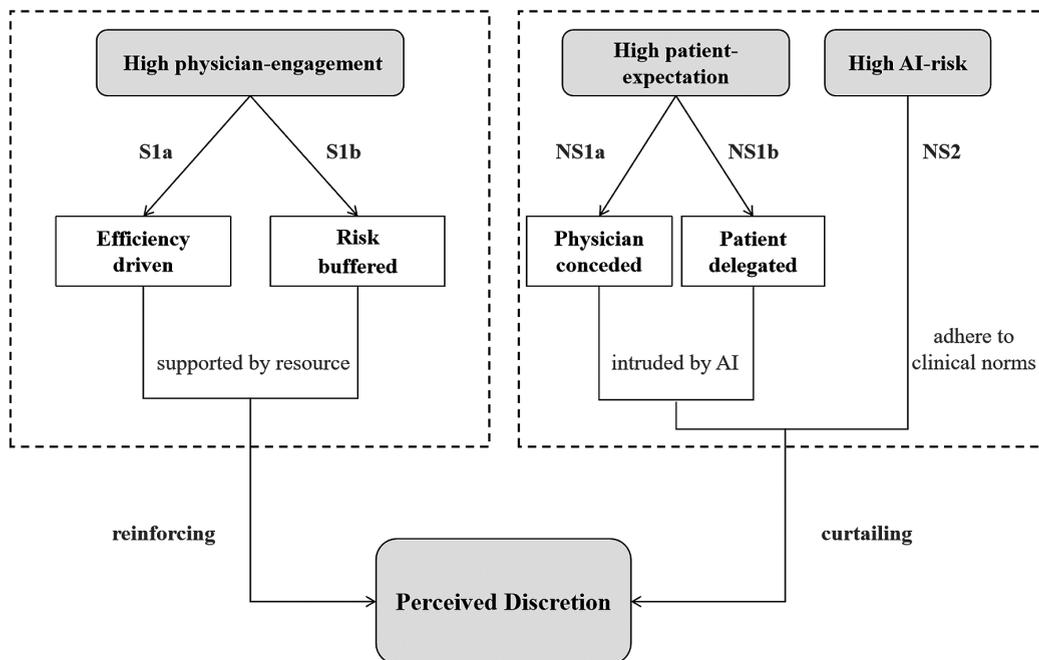


Fig. 2. Five influencing paths of adopting AI on discretion

5.1.1. Substitution effect: high technical usefulness and high technical risk visibility

"The high physician-engagement enforcing" paths, **S1a** and **S1b** reveal that physician active behavior, patient negative attitudes and organizational risk diversification, alongside with the nature of AI, combine together to generate reinforced physicians' perceived discretion. For efficiency driven reinforcement through physician-engagement, **S1a** path, technical usefulness is important, while for risk buffered reinforcement through physician-engagement, **S1b** path, technical high risk visibility is important.

A substitution relationship exists between the nature of AI under the above circumstances, manifested as a substitution relationship between **S1a** path and **S1b** path. Both technical usefulness and high risk

visibility are the nature of AI (Busuioc, 2021; Grimmelikhuijsen, 2023; Yousif *et al.*, 2024). The substitution relationship of technical usefulness and high risk visibility implies that even if AI lacks high usefulness, physicians may still perceive reinforced discretion in an AI-adopted department environment as long as AI demonstrates high risk visibility. This substitution mechanism highlights the flexibility of AI in reinforcing physicians' decision-making. This provides another interpretation of existing research finding that in the high discretion scenario, transparency affected the perceived trustworthiness of algorithmic decision-making (Grimmelikhuijsen, 2023). And we explain from different perspectives that technical transparency is related to reinforced discretion.

5.1.2. Substitution effect: positive patient attitudes, and low technical risk visibility and organizational undispersed liability

For physician conceded curtailment under the high patient-expectation, **NS1a** path, the core condition is the interference exerted by patient positive attitudes toward AI. The patient's positive attitude and the physician's passive behavior, along with other conditions, interplay to form a passive transfer of discretion to AI. The curtailment path **NS2**, "**the high AI-risk curtailment**" reveals that the dual risk burden from the AI itself and the organizational environment, in addition to technical low usefulness, and the negative attitudes of both physicians and patients collectively lead to physicians making more cautious decisions, and they are more willing to follow industry standards and guidelines.

Under certain environment, patient positive attitudes and the dual risk burden can mutually substitute, manifested as a substitution relationship between **NS1a** path and **NS2** path. The comparative analysis of the above two paths reveals that, in cases where AI has low usefulness and physicians passively use AI, positive patient attitude and dual risk burden can alternatively lead to a curtailment in physicians' perceived discretion. On the one hand, in situations where AI has low usefulness and physicians are passively using it, if the patients' attitudes toward AI are positive, physicians' perceived discretion will be conceded to AI. On the other hand, if AI presents high risk visibility and organization fails to disperse relevant liability, physicians' perceived discretion will be transferred to the industry standards and guidelines.

5.2. The influence of AI on discretion varies in different medical contexts

Different departments exhibit distinct paths of physicians' perceived discretion changes. The cardiology and pathology departments demonstrate "the high physician-engagement enforcing" path. The respiratory and critical care medicine, hematology, endocrinology, ophthalmology, and pediatric surgery departments exhibit "the high patient-expectation curtailment" path. The infectious diseases, vascular surgery, cardiac surgery, and ultrasound medicine departments follow "the high AI-risk curtailment" path.

First, in internal medicine settings, physicians' perceived discretion is primarily characterized by "**the high physician-engagement enforcing**" path, such as such as cardiology department, and "**the high patient-expectation curtailment**" path, such as respiratory and critical care department, hematology department and endocrinology and metabolism department. This may be due to the fact that internal medicine typically involves long-term management and treatment, where the patient's attitude and trust are crucial to treatment decisions. The interference of patients' positive attitudes toward healthcare AI on physicians' perceived discretion is particularly pronounced.

Second, in surgical departments, physicians' perceived discretion may manifest as "**the high AI-**

risk curtailing” path, as observed in the vascular surgery department and cardiac surgery department. Surgical decision-making inherently involves high stakes, including life-threatening risks, irreversible procedures, and complex intra-operative variables. Consequently, physicians in these departments exhibit greater sensitivity to technical uncertainty and institutional liability. Moreover, surgical planning often requires a high degree of clinical autonomy and tacit knowledge, which may not be easily substituted by AI systems. Even when AI is adopted, its perceived risks may constrain physicians’ willingness to rely on algorithmic recommendations.

Third, in auxiliary diagnostic and therapeutic departments, physicians’ perceived discretion predominantly follows the **“physician-engagement reinforcement”** path, such as pathology department, and **“the high AI-risk curtailing”** paths, such as ultrasound medicine department. This may reflect the inherent reliance on technology and equipment in these departments, where physicians actively leverage AI to enhance efficiency, while simultaneously remaining cautious about its potential risks. This finding mirrors prior research highlighting radiologists’ ambivalence toward AI: some regard it as a means to alleviate cognitive load, while others perceive it as a threat to their professional and epistemic authority (Lombi and Rossero, 2024).

5.3. Toward a generalizable understanding of AI and discretion in the public sector

While our empirical analysis focuses on the healthcare sector, many of our findings—particularly the interactions between the nature of AI, user behavior, public expectations and organizational environment—are likely to resonate with the tensions across other public sectors. Similar dynamics arising from AI adoption may emerge in public sectors such as education and policing (Lipsky, 1980), where street-level discretion, professional judgment and citizen interaction are important to routine work.

First, the finding that the physicians’ active and voluntary engagement with AI alongside with high technical usefulness or risk visibility would reinforce physicians’ perceived discretion in the healthcare sector coincides with the “algorithmic colleague” view in the policing sector (Meijer *et al.*, 2021). When street-level bureaucrats have considerable discretion in using AI and combining it with their own knowledge, the system would become an instrument for further professionalizing in the police sector (Meijer *et al.*, 2021). This is also the viewpoint of the “enablement thesis” in e-government referred to by Buffat (Buffat, 2015), where AI is believed to act as neutral epistemic tools and provide decision-makers with relevant information (Vredenburg, 2025).

Second, the finding that patients’ attitudes play a core role in limiting physicians’ perceived discretion under certain conditions in the healthcare sector provides empirical evidence for previous studies that AI adoption can affect the relationship between street-level bureaucrats and clients, and impact the power of street-level bureaucrats (Miller and Keiser, 2021). Public expectations can act as a form of social pressure that influences how street-level bureaucrats’ discretion is exercised in the public sector.

Third, the finding that risk burden of AI adoption in healthcare would limit physicians’ perceived discretion forms a dialogue with the discussion related to accountability of AI adoption in the public sector. The accountability of AI pertains that street-level bureaucrats require to explain and justify their decisions informed by AI and face consequences (Yuan and Chen, 2025). Street-level bureaucrats are often reluctant to take responsibility for the mistakes caused by the unpredictable behavior of AI. Under the dual burden of technical risks and organizational accountability (Deng and Sun, 2024), street-level bureaucrats would comply more with the existing administrative regulations and rules, and try their best to ensure that their administrative decisions are within a safe range.

Overall, previous research on the impact of AI adoption on the street-level bureaucrats' discretion has produced a rich body of work, often polarized between enforcing effect (Jorna and Wagenaar, 2007; Ranerup and Henriksen, 2022) and curtailing effect (Bovens and Zouridis, 2002; Buffat, 2015; Thunman *et al.*, 2020). Our study, situated in public healthcare and grounded in a socio-technical systems perspective, advances this research by unpacking the underlying impacting mechanisms and pathways. We have infused rich connotations into the traditional viewpoints of enforcing effect and curtailing effect.

On the one hand, consistent with prior studies, we find that AI can empower street-level bureaucrats by providing additional information and decision-making support. However, this empowerment is not the result of a straightforward, linear relationship; rather, it is shaped by a complex interplay of factors, including the nature of AI, user behavior, and public attitudes.

On the other hand, while much of the existing literature emphasizes the potential for AI to shift discretion from street-level bureaucrats to algorithms, our findings reveal that this process is far from uniform. Discretion may be ceded to AI under external pressure from clients with high AI adoption expectations. But discretion may also be deliberately delegated to technically useful AI, reflecting a form of citizen engagement in public service delivery. Furthermore, as for highly professionalized public services, we observe that reduced discretion may not only be transferred to AI but also to administrative norms and expert consensus.

6. Conclusion

6.1. Summary of the main findings

AI is profoundly reshaping different aspects of governance function in the public sector (van Noordt and Misuraca, 2022). In China, the widespread adoption of healthcare AI in public hospitals has significantly enhanced cost efficiency and operational effectiveness (Sun, 2021), while simultaneously raising critical questions about its influence on professional roles and the boundaries of physicians' perceived discretion (Shortliffe and Sepúlveda, 2018). These developments underscore the need to examine how AI reconfigures the public service delivery. Focusing on the adoption of healthcare AI in public hospitals, our study investigates how AI reshapes professional discretion in the public healthcare sector. Guided by the socio-technical systems perspective, we use fsQCA to develop an integrated analytical framework that captures the interactions among the nature of healthcare AI, physicians' behaviors, patient attitudes, and the organizational environment. Empirical data from departments within the Shandong Provincial Hospital Group provides support for our findings.

The primary findings are as follows. First, two distinct paths are identified through which physicians experience reinforcement of perceived discretion, and three paths through which physicians' perceived discretion is limited. "**The high physician-engagement enforcing**" paths, **S1a** and **S1b**, occurs when patient attitudes do not exert external pressure on physicians, physicians voluntarily and actively use AI, and organizations disperse liability from AI errors. In such contexts, physicians' proactive engagement with AI—based on their evaluations of its utility and risks—enables them to leverage extra resources supported by AI to enhance decision-making in healthcare. "**The high patient-expectation curtailing**" paths, **NS1a** and **NS1b**, emerge in environments characterized by low technical risk perception but strong patient involvement. Here, patients' positive attitude towards AI introduces external pressure, leading physicians to defer more frequently to AI recommendations and thereby transfer part of their discretion to AI. "**The high AI-risk curtailing**" path, **NS2**, arises under conditions of low technical risk visibility and

the absence of organizational liability disperse. Even when both physicians and patients hold negative attitudes toward AI, physicians perceive potential risk exposure, prompting more conservative decision-making and relying more on industry standards and guidelines.

The dynamic interplay between social and technical conditions confirms the seamless integration of technical systems within broader social systems. This echoes previous research finding that organizational context influences the impact of algorithms on organizational patterns (Meijer *et al.*, 2021). Our study reveals that understanding the impact of AI on street-level bureaucrats' perceived discretion requires an integrated analysis of both organizational technical system and social system. In particular, the "high AI-risk curtailing" path has seldom been clearly analyzed simultaneously from both technical and organizational perspectives in previous studies. It indicates that in public sectors such as healthcare, where tasks are highly specialized and uncertain, perceived risk burden of adopting AI would seriously threaten street-level bureaucrats' discretion, leading to transferred discretion to administrative norms and expert consensus.

Second, we find that the technical usefulness, physician behavior, patient attitudes, risk burden shaped by technical risk visibility and organizational risk disperse integrate tightly. Some sub-combinations of the above conditions remain critical and conditionally substituted for other single conditions or sub-combinations in shaping reinforced or limited paths. First of all, the positive use behavior of physicians together with patients' negative attitude towards AI is a key enabling condition for perceived discretionary reinforcement. Through voluntary frequent use and high levels of adoption, physicians could make neutral technology reinforce their perceived discretion. Besides, variation in patient attitudes along with organizational risk disperse is associated with divergent shifts in perceived discretion. Patients' negative attitudes toward healthcare AI emerge as a core causal condition in "physician-engagement reinforcement" paths, while patients' positive attitudes constitute the core causal condition in "the high patient-expectation curtailing" paths. This is consistent with findings in broader public administration research which highlights client participation matters (Abouzahra *et al.*, 2024; Young and Tanner, 2023). What's more, in cases of low technical usefulness and passive use by physicians, "the high patient-expectation curtailing" path and "the high AI-risk curtailing" path could be substituted, by replacing patients' positive attitudes and the high risk burden shaped by low technical risk visibility and undispersed organizational risk. And in "the high physician-engagement enforcing" paths, the nature of AI can substitute mutually. This achieves an equivalence substitution among causal conditions, which is also a type of insight that the fsQCA method is particularly well-suited to reveal (Rihoux and Ragin, 2009).

Third, we find that the influencing path of AI adoption on physicians' perceived discretion varies across healthcare contexts, such as between different departments in public hospitals. First, in the context of internal medicine, physicians' perceived discretion is predominantly reinforced through "the high physician-engagement enforcing" path, or limited through "the high patient-expectation curtailing" path. Besides, in the context of surgical medicine, physicians' perceived discretion may be limited through "the high AI-risk curtailing" path. What's more, in auxiliary diagnostic departments, physicians' perceived discretion is primarily reinforced through "the high physician-engagement enforcing" path, while limited through "the high AI-risk curtailing" path. This again echoes prior scholarly emphasis that AI's impact on street-level bureaucrats' discretion is context-dependent, shaped by organizational and task-specific characteristics (Bullock *et al.*, 2020).

6.2. Theoretical implication

Our findings have several theoretical contributions. First, existing research in the field of public administration has explored the theoretical impact of technological advancements on the discretion of street-level bureaucrats (Bovens and Zouridis, 2002; Buffat, 2015; Snellen *et al.*, 2012). However, there is still a lack of empirical studies examining the complex mechanisms through which technological advancements influence their perceived discretion. Our analysis reveals the paths—both enforcing and curtailing, capturing the complex and non-linear mechanisms through which AI adoption influences perceived discretion. Meanwhile, through empirical research, we have expanded the possible paths of enforcing and curtailing effect, especially the discretion transfer path to administrative norms and expert consensus under the curtailing effect. We offer a more realistic and grounded understanding of AI implementation in public services.

Second, we apply the socio-technical systems perspective to examine the impact of AI on the discretion of street-level bureaucrats, enriching the application of the theory to the public sector. We use empirical data to reveal how the interdependence between technological infrastructures and social factors influences discretion within public organizations. We further reinforce the view that the impact of AI adoption is a transformation of the socio-technical relationship between bureaucrats and their tools (Vogl *et al.*, 2020). These findings provide a valuable reference for the application of socio-technical systems perspective in public administration research, particularly in understanding governance challenges in the context of AI decision-making.

Third, drawing on the healthcare context, we deepen our understanding of how AI reshapes street-level bureaucratic discretion by unpacking the interaction of the nature of AI, the behavior of physicians, the attitude of patients, and the organizational environment. By analyzing different paths of street-level bureaucrats perceive in AI contexts, we reveal the dynamic interplay between technical and social conditions. Since the systematic examination of user behavior, public attitude, and organizational environment is seldom, we contribute to the literature by responding to the need for attention to the organizational preconditions for successful AI adoption (Schiff *et al.*, 2025). This provides insight into a more nuanced and context-sensitive view of professional power perception in the era of AI.

6.3. Practical implication

Our findings offer several practical implications: First, achieving the dual goals of improving healthcare service quality and enhancing healthcare delivery capacity by AI requires balancing technical advancement with the cultivation of social foundations. To begin with, the ultimate objective of technological advancement is to reinforce physicians in diagnosis and treatment, expand high-quality healthcare resources nationally, and balance the allocation of healthcare resources across the country, and improve the welfare of residents. To achieve this, technological advancement must be supported by corresponding social foundations, including patient management and organizational institutions. Besides, as internal medicine, surgery, and auxiliary diagnostic departments encounter different tasks in healthcare, refined governance tailored to different healthcare departments is required in the AI era.

Second, our findings indicate that patients' attitudes can influence the impact of AI on physicians' perceived discretion. Rather than allowing overly optimistic or excessively skeptical views to dominate, public administrators should promote a rational and objective perception of healthcare AI among the public. And the stakeholders, such as industry associations, and social organizations, could also actively engage in shaping public understanding of AI. Together, these efforts can help create a more supportive

environment for physicians to integrate AI into healthcare practice effectively.

Third, high technological risks and the concentration of healthcare liability play a critical role in shaping physicians' perceived discretion and bring ethical challenges (Mergel *et al.*, 2023). National regulatory and approval agencies should take into account risk compliance standards when evaluating emerging healthcare technologies such as AI. By clarifying liability boundaries and reducing the burden of responsibility on physicians, such efforts can support the safe and effective integration of AI into medical practice. This would contribute to taking advantage of AI in improving medical quality and efficiency.

6.4. Limitation and future research

First, our study may not be fully generalized to the private sector, since it has a focus on the public sector. The healthcare AI operates under specific regulatory, cultural, and institutional logic in the public healthcare context. Future research could undertake comparative studies across countries or cultures to assess whether similar discretionary dynamics emerge under different contexts. Second, we focus on physicians' perceived discretion to conduct our study. Although perceived discretion is crucial to understanding decision-making behavior under the AI era, triangulating this data with external observations, such as AI audit logs, supervisor evaluations, could offer a more comprehensive picture of actual discretion exercised under algorithmic influence. Third, we adopt a static socio-technical systems perspective to examine the complex relationships influencing perceived discretion in the context of AI adoption. Further studies should also concern the consideration of the dynamics of time and capture how these configurations may evolve over time. As AI development is dynamic, future research could extend the temporal scope and apply dynamic QCA to explore how discretion-related mechanisms shift and develop over time.

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Conflicts of interest

The authors declare no conflict of interest.

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