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How Knowledge Sharing Influences Patient Health Literacy and Doctor-Patient Trust: Evidence from Chronic Disease Doctors in China

LU Renjie

Doctor of Management

Supervisor:
PhD MA Shaozhuang, Associate Professor with Habilitation,
ISCTE University Institute of Lisbon

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Abstract

Guided by the Theory of Planned Behavior, this study was designed to provide a comprehensive understanding of the formation of chronic disease doctors' behavioral intention and actual behavior of knowledge sharing with patients and their associations with perceived patient health literacy, and doctor-patient trust. The moderating effect of job effort was also examined.

From March to April 2024, 607 valid questionnaires were collected from chronic disease doctors in 39 hospitals across 16 Chinese cities. Hypotheses were tested using Mplus version 8.3.

The findings confirm attitudes, subjective norms, and perceived behavioral control as antecedents of behavioral intention to share knowledge. Additionally, it indicates that:

1. Behavioral intention partially mediates the link between perceived behavioral control and the actual behavior of knowledge sharing.
2. Perceived patient health literacy partially mediates the relationship between the actual behavior of knowledge sharing and doctor-patient trust.
3. Sequential mediation exists from antecedents of behavioral intention to doctor-patient trust via behavioral intention, actual behavior, and perceived patient health literacy.
4. Most importantly, job effort attenuates the positive relationships between behavioral intention and actual behavior of knowledge sharing and between actual behavior of knowledge sharing and perceived patient health literacy. Specifically, the above relationships were less significant when doctors reported higher levels of job effort.

This empirical study provides theoretical insights into the factors promoting knowledge sharing behavior between chronic disease doctors and patients, and highlights the critical role of job effort on doctors' actual behavior of knowledge sharing and perceived patient health literacy. It also offers practical guidance for enhancing patient health literacy and improving doctor-patient trust, with management implications for governments, hospitals, doctors, and patients.

Keywords: Theory of Planned Behavior; chronic diseases; knowledge sharing; doctor-patient trust; patient health literacy; job effort

JEL: M54; M12

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Resumo

Guiado pela Teoria do Comportamento Planeado (*Theory of Planned Behavior*, TPB), este estudo tem como objetivo fornecer uma compreensão abrangente da formação da intenção comportamental e do comportamento real de partilha de conhecimento dos médicos de doenças crónicas com os pacientes, bem como das suas associações com a perceção da literacia em saúde do paciente e a confiança médico-paciente. O efeito moderador do esforço no trabalho também foi analisado.

Entre março e abril de 2024, foram recolhidos 607 questionários válidos junto de médicos de doenças crónicas em 39 hospitais de 16 cidades chinesas. As hipóteses foram testadas utilizando o Mplus 8.3.

Os resultados confirmam que a atitude, as normas subjetivas e o controlo comportamental percebido são antecedentes da intenção comportamental de partilhar conhecimento. Além disso, indicam que:

1. A intenção comportamental medeia parcialmente a relação entre o controlo comportamental percebido e o comportamento real de partilha de conhecimento.
2. A perceção da literacia em saúde do paciente medeia parcialmente a relação entre o comportamento real de partilha de conhecimento e a confiança médico-paciente.
3. Existe uma mediação sequencial desde os antecedentes da intenção comportamental até à confiança médico-paciente, passando pela intenção comportamental, o comportamento real e a perceção da literacia em saúde do paciente.
4. Mais importante ainda, o esforço no trabalho atenua as relações positivas entre a intenção comportamental e o comportamento real de partilha de conhecimento, bem como entre o comportamento real de partilha de conhecimento e a perceção da literacia em saúde do paciente. Especificamente, estas relações mostraram-se menos significativas quando os médicos relataram níveis mais elevados de esforço no trabalho.

Este estudo empírico fornece insights teóricos sobre os fatores que promovem o comportamento de partilha de conhecimento entre médicos de doenças crónicas e pacientes e destaca o papel crítico do esforço no trabalho no comportamento real de partilha de conhecimento dos médicos e na perceção da literacia em saúde do paciente. Também oferece orientações práticas para a melhoria da literacia em saúde do paciente e o fortalecimento da

confiança médico-paciente, apresentando implicações de gestão para governos, hospitais, médicos e pacientes.

Palavras-chave: Teoria do Comportamento Planeado; doenças crónicas; partilha de conhecimento; confiança médico-paciente; literacia em saúde do paciente; esforço no trabalho
JEL: M54; M12

摘　要

本研究以计划行为理论为指导，旨在全面理解慢性病医生与患者之间知识共享行为意向与实际行为的形成机制，以及它们与感知患者健康素养和医患信任之间的关系，并检验工作付出在这一过程中的调节作用。

在2024年3月至4月期间，本研究从中国16个城市的39家医院收集了607份有效问卷，并使用了Mplus 8.3软件对假设进行了检验。

研究结果证实了知识共享态度、主观规范和感知行为控制是行为意向的前因变量。此外，本研究还发现：

1. 知识共享行为意向在感知行为控制与实际行为之间起部分中介作用。

2. 感知患者健康素养在知识共享实际行为与医患信任之间起部分中介作用。

3. 从行为意向的前因变量到医患信任之间存在通过行为意向、实际行为以及感知患者健康素养的链式中介效应。

4. 最重要的是，工作付出削弱了知识共享行为意向与实际行为之间的正相关，以及知识共享实际行为与感知患者健康素养之间的正相关。具体而言，当医生报告更高的工作付出水平时，上述关系的显著性降低。

本实证研究为理解慢性病医生知识共享行为的促进因素提供了理论见解，并强调了工作付出在医生知识共享实际行为和感知患者健康素养中的关键作用。此外，本研究还为提升患者健康素养和改善医患信任提供了实践指导，对政府、医院、医生和患者具有管理启示和意义。

关键词：计划行为理论；慢性病；知识共享；医患信任；患者健康素养；工作付出

JEL: M54; M12

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I still clearly remember the countless virtual meetings and in-depth discussions with Professor Ma. He was always patient in addressing each issue, offering valuable suggestions to improve my work. Whenever I faced difficulties or challenges in research, Professor Ma would patiently discuss them with me, provide inspiration, and help me find solutions. In times of setback, he always encouraged me with examples from senior researchers, reminding me that while the research journey is arduous, perseverance would ultimately lead to success.

Professor Ma's in-depth reflection on each research topic and respect for scientific discovery have shown me the sacred and noble nature of academic research. Under his mentorship, I have learned how to pursue excellence in research, seek opportunities amongst challenges, and learn from failures. His encouragement and guidance have strengthened my determination and confidence in my academic journey. He not only taught me how to write a high-quality thesis but also made me embrace a craftsman's spirit—striving for perfection in every detail and continually exploring the unknown.

I would like to extend my highest respect and sincerest gratitude to Professor Ma for his unwavering support and continuous assistance during this journey. I am committed to advancing in my academic career, aspiring to become an outstanding researcher.

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致　谢

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从最初踏入科研的大门，到如今即将完成科研项目，每一步都离不开马教授的悉心指导与无私奉献。马教授严谨的治学态度、深邃的学术洞察力以及孜孜不倦的科研精神，深深感染了我，让我在科研的道路上不断前行，不断突破自我。在论文的撰写过程中，马教授更是倾注了大量心血。从选题、开题，到研究设计、数据分析，再到论文的撰写与修改，每一个环节都离不开马教授的悉心指导与严格把关。

直到现在，依然还清晰地记得跟马教授的一次次视频会议交流、一次次的讨论细节修改。马教授总是耐心地与我探讨每一个问题，提出宝贵的建议与意见，使我的论文得以不断完善。每当我在研究中遇到困难和挑战时，马教授总是耐心地与我讨论，启发我的思路，帮助我找到解决问题的方法。每当我遇到挫折时，马教授总是用师兄和师姐的亲身经历和科研精神激励我，让我明白科研的道路虽然充满艰辛，但只要坚持不懈，就一定能够收获成功。

马教授对每一个研究问题的深入挖掘，以及对每一个科学发现的尊重和珍视，都让我深刻体会到了科研工作的神圣和崇高。在马教授的言传身教下，我学会了如何在科研中追求卓越，如何在挑战中寻找机遇，以及如何在失败中汲取教训。马教授的鼓励和启发，使我在科研的道路上更加坚定和自信。马教授不仅教会了我如何撰写一篇优秀的论文，更重要的是，让我学会了如何以工匠精神对待科研，追求每一个细节的完美，不断探索未知。

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List of Abbreviations

AB = Actual Behavior of Knowledge Sharing

AIC = Akaike Information Criterion

ATT = Attitudes Toward Knowledge Sharing

AVE = Average Variance Extracted

BI = Behavioral Intention to Knowledge Sharing

BIC = Bayesian Information Criterion

CFA = Confirmatory Factor Analysis

CFI = Comparative Fit Index

CITC = Corrected Item-Total Correlation

CMIN/DF = Chi-square-DOF Ratio

CR = Construct Reliability

DF = Degree of Freedom

DPT = Doctor-Patient Trust

EFA = Exploratory Factor Analysis

ERI = Effort-Reward Imbalance

JE = Job Effort

KMO = Kaiser-Meyer-Olkin

KS = Knowledge Sharing

PBC = Perceived Behavioral Control for Knowledge Sharing

PPHL = Perceived Patient Health Literacy

RMSEA = Root Mean Square Error of Approximation

SEM = Structural Equation Model

SN = Subjective Norms for Knowledge Sharing

SRMR = Standardized Root Mean Square Residual

TLI = Tucker-Lewis Index

TPB = Theory of Planned Behavior

χ^2 = Chi-Square

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Chapter 1: Introduction

This chapter will present the research background by pointing out the current challenges in the field, define the research objectives, and identify the research problem.

1.1 Research background

In the healthcare sector, due to the increasing complexity of medical knowledge and the generally low health literacy levels of the public, efforts to prevent and treat chronic diseases have become particularly arduous. Disseminating medical knowledge at the societal level alone is insufficient to address all the problems encountered in specific medical scenarios. In this context, doctors, as authoritative disseminators of medical knowledge, play a crucial role in knowledge sharing. However, at the same time, they face challenges arising from policy, societal expectations, digital environments, time constraints, and communication skill requirements.

1.1.1 Complexity of medical knowledge

Over the past century, medical knowledge has grown exponentially (Arora et al., 2014). This rapid growth has led to information overload, along with challenges in understanding and utilizing this knowledge (Gauer & Jackson, 2017; Wartman & Combs, 2019). Additionally, due to limitations in medical research, existing knowledge cannot fully address all disease-related problems, especially in the field of chronic diseases.

(1) Information overload

Advancements in disease research, technology, and information dissemination have accelerated the generation and spread of medical knowledge. Currently, there is a huge number of recognized diseases of numerous types, with approximately 10,000 identified rare diseases alone (Smith et al., 2022). As diagnostic technologies continue to advance, this number may continue to grow. Besides, new experimental techniques, imaging modalities, and gene sequencing technologies are driving further breakthroughs and discoveries. Moreover, increased information exchange enables rapid spread of new ideas and findings, fueling continuous updates in knowledge (Happell, 2007; Young & Cox, 2015). Chronic diseases often

involve complex mechanisms with multiple factors intertwined, requiring patients to possess a broader and deeper understanding of medical knowledge. However, for most patients, mastering all this information is nearly impossible. The information overload may lead to problems such as confusion, delayed decision making, lack of critical assessment, refusal to communicate, anxiety, and stress.

(2) Comprehension difficulty

The specificity of medical terminology and the individual differences in disease mechanisms create barriers for the public in comprehending and applying medical knowledge. Medical terminology often derives from Latin or Greek (Saeed & Naveed, 2022), posing challenges to public understanding despite their assistance in precisely expressing and transmitting medical knowledge. Additionally, health education materials may exceed the comprehension abilities of chronic disease patients, forcing them to abandon their efforts to learn (Liu & Kuo, 2016). Moreover, most diseases arise from the interaction of multiple factors such as genetics, environment, and immunity, leading to variability in disease manifestations across individuals (Weaver, 2021). This variability is particularly pronounced in chronic diseases, where understanding requires navigating a higher cognitive threshold. Patients must not only grasp the broader knowledge about their disease but also the information about personalized treatment plans and disease presentation.

(3) Limitations of medical knowledge

Medical knowledge limitations hinder the understanding and treatment of diseases on multiple levels. For instance, many chronic diseases involve complex mechanisms that are not yet fully understood by the medical community, with no definitive treatments available. Additionally, research findings in biomedicine can sometimes be inconsistent or contradictory (Alamri & Stevenson, 2016), complicating patients' ability to adopt and trust medical knowledge. Furthermore, researchers often use specific inclusion and exclusion criteria to enhance result accuracy (Patino & Ferreira, 2018). While this approach enhances the internal validity of the research, it may also limit the generalizability of the findings (Stel et al., 2009) as strict inclusion and exclusion criteria often exclude individuals with specific characteristics or in special conditions. In practice, while patients benefit from evidence-based knowledge, they also require tailored, personalized information.

1.1.2 Public health literacy brings challenges in chronic disease prevention

With an aging population and changes in lifestyle, the burden of chronic diseases has become increasingly significant (Du et al., 2019; Yin et al., 2022). Chronic conditions such as

cardiovascular disease (Lv et al., 2017), diabetes, and chronic respiratory diseases have shown rising prevalence in China (Fang et al., 2018; Shen et al., 2016). Despite progress in improving health literacy over the past decades, only about one-quarter of the Chinese population possesses basic health knowledge and skills, leaving the majority at a low level of health literacy (Liu et al., 2023; Mei et al., 2023), which poses significant challenges to chronic disease prevention and management.

(1) Increased disease risk

Low health literacy is closely related to higher chronic disease prevalence (Asharani et al., 2021; Baker et al., 1997). Individuals with low health literacy often lack sufficient understanding of the causes, symptoms, risks, and prevention measures associated with chronic diseases, making it difficult to recognize early warning signs and resulting in missed opportunities for timely intervention. Furthermore, individuals with low health literacy may lack health awareness and basic skills and knowledge (Asharani et al., 2021), which may hinder their ability to adopt healthy habits, such as quitting smoking, maintaining a balanced diet, and exercising regularly. The widespread availability of incorrect health information online further exacerbates this issue, as individuals with low health literacy are more likely to be misled by unreliable sources, resulting in inappropriate health behaviors (Bin Naeem & Kamel Boulos, 2021).

(2) Poor treatment outcomes

Limited health literacy impedes effective doctor-patient communication (Nouri & Rudd, 2015). Chronic disease patients with low health literacy may struggle to articulate their health needs and concerns or to comprehend complex medical terminology and concepts, which can hinder accurate interpretation of treatment plans, collaborative decision making, and successful execution of prescribed interventions. Compared to individuals with sufficient health literacy, those with limited health literacy are more likely to misunderstand health information (Friedman et al., 2006). Moreover, chronic diseases are often long-term conditions that require ongoing management rather than cures (Liu et al., 2023). Research consistently reports a positive association between health literacy and medication adherence (Hyvert et al., 2023; Selvakumar et al., 2023). Patients with low health literacy are more likely to struggle with self-management, leading to poor disease control or even worsening conditions. These patients also tend to report lower health-related quality of life (Alhalal et al., 2023).

(3) Waste of medical resources

Health literacy plays a pivotal role in the successful self-management of chronic diseases (Heijmans et al., 2015). Patients with low health literacy often fail to manage their health

adequately at home, increasing reliance on healthcare services such as hospital admissions and emergency care. The overly-frequent consultations and excessive examinations lead to medical resource waste. Inadequate prevention and management among these patients may lead to worsening conditions and the development of complications (Liu et al., 2023). Moreover, higher severity of comorbidities is associated with lower health literacy levels (Dinh et al., 2022). Frequent relapses and more severe complications will complicate treatment and impose medical burdens.

(4) Increased social burden

Chronic diseases have a far-reaching impact on individuals' health and quality of life, as well as on the healthcare resources and economy of society (Wei et al., 2020; Zhu et al., 2018). This trend is further exacerbated by low health literacy, leaving more patients unable to effectively manage their conditions and increasingly reliant on medical resources in a long run. Compared to individuals with adequate health literacy, those with limited literacy are more likely to revisit emergency departments (Shahid et al., 2022). Moreover, while the Chinese government has implemented strategies to prevent and control non-communicable diseases (S. Liu et al., 2020), the implementation and effectiveness of these efforts may be hindered if public health literacy remains low.

In summary, enhancing public health literacy is a crucial means of mitigating chronic disease risks, improving treatment outcomes, reducing medical resource wastage, and alleviating societal burdens. However, the satisfaction of Chinese residents with community health education remains low (Tong et al., 2022). Currently health education materials often fail to meet the public's health management needs in terms of content, format, and delivery methods (R. Zhang et al., 2020), and online health information varies widely in quality (Moorhead et al., 2013). Consequently, doctors, as trusted sources of health information, play an irreplaceable role in improving patient health literacy during clinical encounters (Brach et al., 2014; Pleasant et al., 2016). Patients with chronic diseases need to engage in more frequent and in-depth communication with doctors during the treatment process, which is more likely to lead to knowledge sharing.

1.1.3 The critical role of doctors in knowledge sharing and the challenges faced

In general, research on doctor-patient communication has primarily treated it as a holistic concept, with limited attention paid specifically to knowledge sharing as a distinct linguistic dimension of doctor-patient communication. While effective doctor-patient communication has been proven to enhance patients' understanding of health information, bridge knowledge gaps,

and foster collaboration and mutual understanding between doctors and patients (Dewalt & Pignone, 2005), the factors influencing knowledge sharing between doctors and patients and its outcomes may differ from those of general doctor-patient communication.

In the context of healthcare, knowledge sharing refers to the transfer of knowledge between key service parties (e.g., doctors and patients) (Bryant et al., 2012). Doctors play a critical role in shaping patients' ability to understand and apply medical knowledge (Pleasant et al., 2016). While patients' high levels of health literacy may compensate for deficiencies in doctor-patient communication to some extent, they cannot entirely address communication challenges, such as limited consultation time (Sun & Rau, 2017). On the other hand, even when patients have limited health literacy, doctors equipped with effective communication skills and patient-centered approaches can improve communication effectiveness and quality (Kripalani et al., 2010; Tseng et al., 2020), minimizing potential negative impacts on knowledge-sharing quality.

By listening to patients, showing empathy, and making clear articulation of medical information, doctors can enhance the patient health literacy (Chen & Kapadia, 2022; Veenker & Paans, 2016), improve patients' comprehension of health information (Sadeghi et al., 2013), and foster doctor-patient collaboration and mutual understanding (Dewalt & Pignone, 2005). As a result, doctors play a pivotal role in facilitating high-quality knowledge sharing (Strous & Karni, 2020). In the management of chronic diseases, doctors serve as providers of authoritative and personalized knowledge, long-term guides supports for disease management, and key agents in building trust. However, in practice, doctors' execution of specific clinical behaviors are jointly influenced by a few personal, social, economic, political, and organizational factors (Perkins et al., 2007). In China, chronic diseases doctors face challenges in knowledge sharing imposed by the policy, society, and digital environments, as well as individuals' time constraints and communication skills.

(1) Policy

Since the introduction of market mechanisms in China's healthcare system during the reform and opening-up, hospitals have faced increasing competition (Xian, 1992). The cancellation of drug price markups in 2017 reduced hospital revenue streams from three sources—government subsidies, medical service fees, and drug markup revenue—to two: government subsidies and medical service fees. In addition, to sustain the medical insurance system, a payment system based on diagnosis-related groups was introduced (Yuan et al., 2019). These reforms have constrained public hospitals' revenue growth (Gao et al., 2021), directly impacting doctors' salaries. Low remuneration may drive some doctors to seek supplementary income through practices such as overtreatment (Zhu et al., 2021).

For example, following the cancellation of drug price markups, the proportion of medication costs in outpatient and inpatient expenditures has decreased annually, while examination fees have increased (see Figure 1.1). In response, hospitals and doctors have sought alternative income sources, often by accelerating patient consultations and increasing the number of examinations and procedures. However, such practices may deprioritize doctor-patient knowledge sharing, despite its established association with healthcare quality and patient satisfaction. Unfortunately, comprehensive assessments, consultations, and educational services provided by doctors are rarely incentivized (Jeong, 2012; Wagner et al., 1996). Almost no performance appraisal systems consider knowledge sharing as an independent evaluation indicator (Lai et al., 2023; Lin et al., 2019). Consequently, under market-driven pressures, the role of chronic disease doctors is inevitably influenced by economic factors, with insufficient motivation for engaging in knowledge sharing with patients.

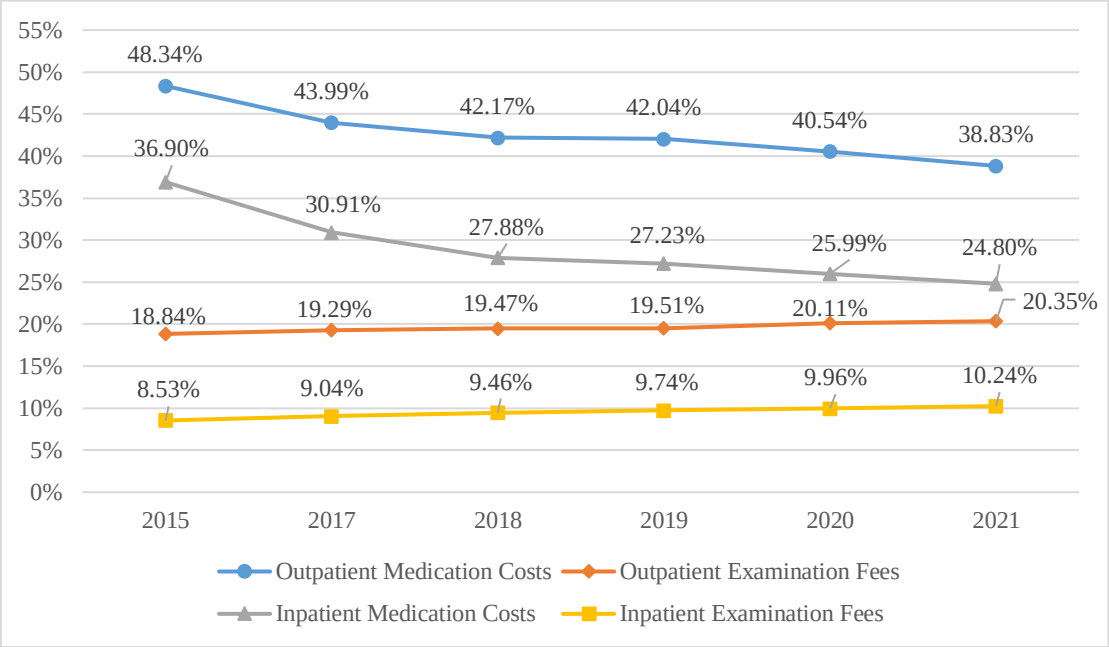

Figure 1.1 Proportions of drug costs and examination fees in public hospitals over time (2015–2021)

Source: National Health Commission of the People's Republic of China (NHC) (2022)

(2) Society

With rapid economic development and the widespread promotion of democratic and legal principles, Chinese patients and their families have become increasingly aware of their rights (Jiang et al., 2020). However, extreme approaches to dispute resolution often escalate medical conflicts. In some cases, patients or their families resort to excessive or even malicious actions to seek compensation or gain financial benefits from medical disputes. Data from 2013 to 2021 show a gradual rise in the number of workplace violence incidents in healthcare settings, peaking in 2016 (Xiao et al., 2022) (see Figure 1.2). The decline in such incidents during 2020

and 2021 may be attributed to the widespread use of telemedicine and reduced outpatient and inpatient visits during COVID-19 (Özdamar Ünal et al., 2022). Incidents of violence in healthcare settings disrupt the normal functioning of medical institutions and often lead to significant financial compensation costs (Zhou et al., 2017).

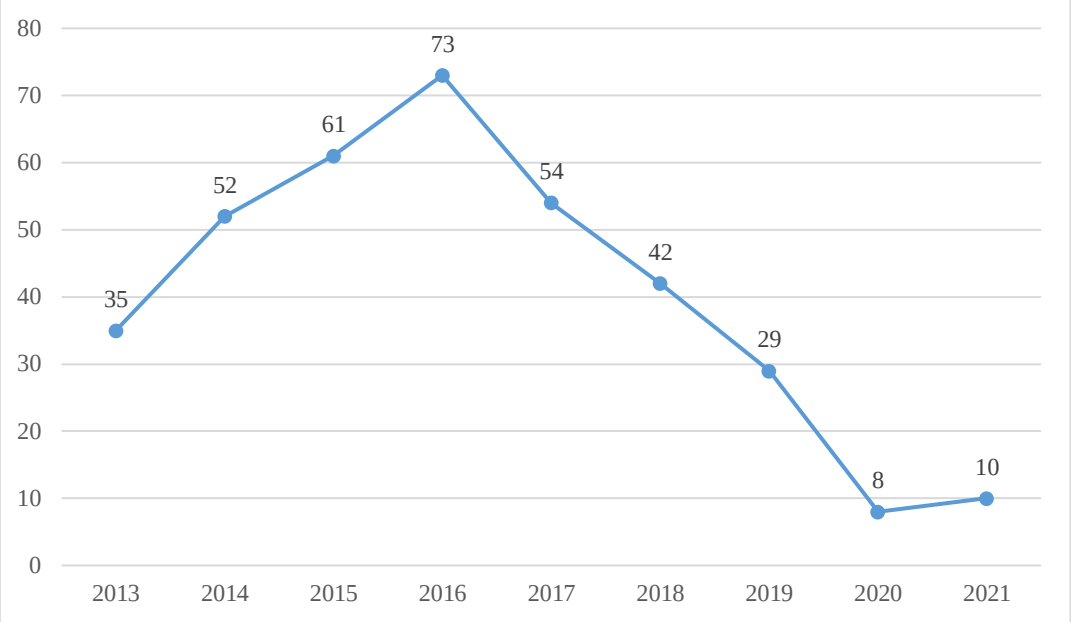

Figure 1.2 Frequency of workplace violence in healthcare settings in China (2013–2021)

Source: Xiao et al. (2022)

To mitigate medical risks, avoid legal liabilities, and prevent disputes, many Chinese healthcare professionals adopt defensive medical practices (He, 2014). In such an environment, doctors may be inclined to reduce communication efforts (Nie et al., 2018). For example, some doctors, aiming to preserve evidence for potential lawsuits and avoid accusations of negligence, may order more examinations and prescribe additional medications (He, 2014). Over-reliance on test results, medical guidelines, or standardized procedures to obtain objective evidence can prevent doctors from fully addressing patients' psychological needs and key concerns. Consequently, under the pressure of legal and medical disputes, chronic disease doctors may adopt a self-protective approach that limits in-depth knowledge sharing.

(3) Digital environment

With the rapid development of the internet, public demand for health information and the frequency of online health information searches have surged. Patients increasingly perceive online health information as a means to enhance their medical knowledge (Zhou et al., 2020), boost confidence in addressing uncertainties (Niu et al., 2021), and improve doctor-patient communication outcomes (Cao et al., 2016). However, the internet contains a mix of authoritative health information and misinformation, varying significantly in quality (Meng et

al., 2022; Zhou et al., 2020). Individuals with low health literacy are particularly vulnerable to being misled by unreliable sources (Bylund et al., 2007). Moreover, the overwhelming volume of online health information further increases the difficulty of screening and understanding accurate content (Jiang & Liu, 2020).

The availability of online health information has altered the interaction dynamics between doctors and patients in the consultation room. Some patients may compare information obtained online with doctors' professional advice. Discrepancies between the two may lead patients to question their doctors' professionalism (Z. Zhang et al., 2021), prompting defensive reactions among some doctors (R. Lu et al., 2023). Additionally, patients who have obtained online health information may seek greater involvement in medical decisions and demand shared decision making. Such redistribution of decision making power can be perceived as a challenge to doctors' authority (Broom, 2005). Furthermore, correcting patients' misunderstandings based on erroneous online information can consume doctors' additional time (R. Lu et al., 2023; Moick & Terlutter, 2012). Therefore, confronted with unrealistic patient expectations, imbalanced authority, and increased time pressures, chronic disease doctors may exhibit resistance or negative attitudes toward knowledge sharing.

(4) Time constraints

In recent years, China's large population and growing health awareness have led to an overwhelming number of patients visiting doctors (Wu et al., 2013). On average, Chinese doctors work more than 10 hours per day (Hu et al., 2016). They also frequently undertake additional learning tasks during non-working hours (Tian et al., 2020). Furthermore, doctors in tertiary hospitals bear significantly heavier workloads than those in secondary and primary hospitals (See Figure 1.3). In hospitals with higher levels, doctors' workloads tend to be higher (Li & Xie, 2013; Wu et al., 2014). Patients, regardless of the severity or complexity of their conditions, often prefer tertiary hospitals (Li et al., 2020). At these hospitals, excessive patient volumes result in prolonged waiting times and brief consultations (Liu et al., 2019). In primary healthcare facilities, general practitioners often allocate most of their time to prescribing requested medications and providing basic public health services, leaving insufficient time for adequate patient education (Jin et al., 2015). Overall, inadequate consultation time remains a prominent issue in Chinese healthcare settings (Liang et al., 2021).

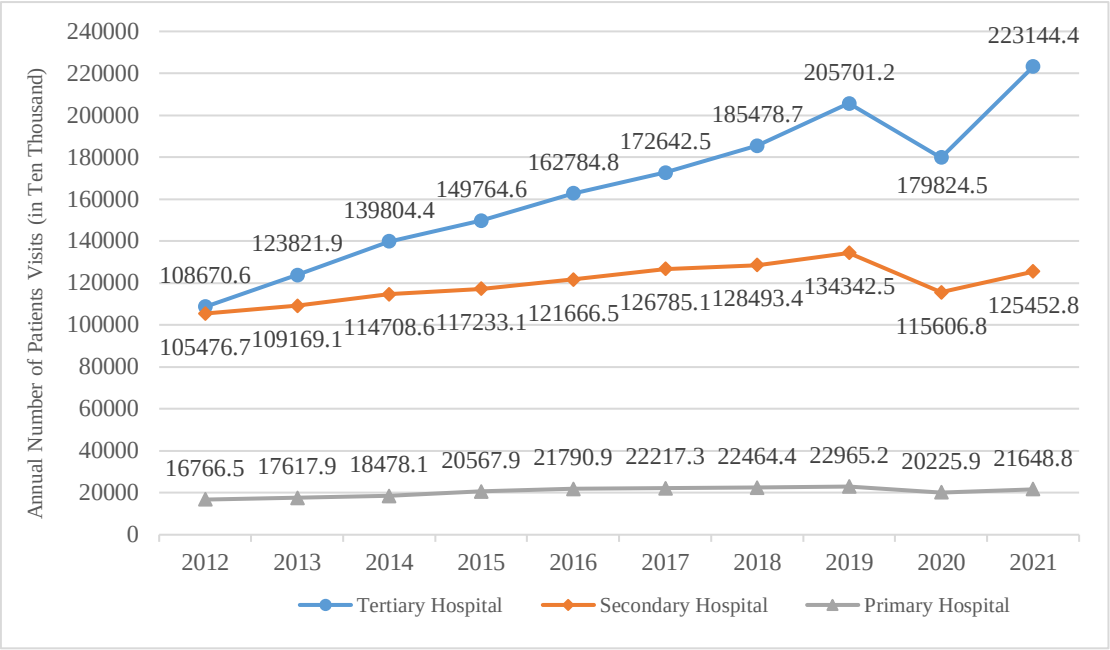

Figure 1.3 Annual average number of consultations handled by physicians in China (2012–2021)

Source: National Health Commission of the People's Republic of China (NHC) (2017, 2022)

Time constraints negatively affect the behavior and effectiveness of chronic disease doctors' knowledge sharing. In China, short consultation times, usually lasting 3-5 minutes (Su et al., 2010), make it difficult for doctors to thoroughly explain the key information, such as disease causes, treatment plans, and precautions. Simultaneously, patients may struggle to fully express their concerns and needs within the limited time. Additionally, prolonged exposure to high workloads can lead to emotional exhaustion and burnout among Chinese doctors (Wu et al., 2013). Such negative emotions can diminish doctors' patience and enthusiasm, undermining the effectiveness of knowledge sharing. Moreover, China is facing a shortage of doctors and an imbalance between the supply and demand of healthcare services (S. Zhang et al., 2020). Under high workload, some doctors may prioritize basic medical services over detailed communication, opting to expedite consultations by limiting the time for discussion or interrupting patients (Rhoades et al., 2001). These practices can compromise the completeness and continuity of knowledge transfer.

(5) Communication skills

Overall, there is significant room for improvement in Chinese doctors' communication skills to enhance doctor-patient relationships (Du et al., 2022). Many consider communication skills as critical as, if not more important than, technical expertise (Hall et al., 1981). However, China's medical education and training systems exhibit notable deficiencies regarding doctor-patient communication. For instance, communication skills are often not included as compulsory courses in medical school curricula (Li et al., 2020; Liu et al., 2015), and practical

training in this regard is often neglected (Choudry et al., 2016; Jiang et al., 2020). In professional settings, communication skills are rarely prioritized as an essential component of doctors' professional training (Lo & Hsieh, 2020). Consequently, Chinese doctors often rely on self-exploration and experiential learning to develop communication skills during clinical practice (Jiang et al., 2020; Sun & Rau, 2017). Furthermore, in Chinese medical culture, the doctor-patient relationship is characterized doctor-centered communication (Fritzsche et al., 2012), resulting in doctors' insufficient motivation to pursue communication training.

Insufficient communication skills adversely affect knowledge sharing among chronic disease doctors. Challenges may arise in doctor-patient communication, such as the digital literacy gap among elderly patients (Liu et al., 2021), hearing-impaired patients (Xu et al., 2021), and patients' fears of discrimination and stigmatization (Liu et al., 2022). Doctors with insufficient communication skills may struggle to simplify complex medical terminology, resulting in increased difficulty in patient comprehension (Makoul & Curry, 2007; Tamblyn et al., 2007). Moreover, they may fail to fully consider individual patient's needs and expectations (Gao et al., 2024). This not only limits doctor's comprehensive understanding of the patient's health condition but also makes them fail to consider individual differences, thereby affecting the development and implementation of personalized treatment plans. Therefore, insufficient communication skills not only undermine trust between doctors and patients (Du et al., 2022) but also reduce patient satisfaction with their medical experiences (Gao et al., 2024) and may even trigger defensive medical practices (Sun & Rau, 2017).

In summary, chronic disease doctors, as authoritative disseminators of medical knowledge, play a key role in knowledge sharing. However, these doctors face numerous challenges in promoting knowledge sharing, including constraints imposed by the policy, society, the digital environment, time constraints, and insufficient communication skills. These challenges may influence the knowledge sharing between chronic disease doctors and patients, which, in turn, affects patient health literacy (see Figure 1.4). Although the Chinese government and some hospitals' management have started to recognize the importance of knowledge sharing in doctor-patient relationships, a lack of deep understanding of the factors and outcomes associated with knowledge sharing hinders their ability and motivation to encourage chronic disease doctors to engage actively in such behavior. Therefore, exploring the factors influencing knowledge sharing behavior among chronic disease doctors, the mechanisms involved, and its effects is critical to improving chronic disease management.

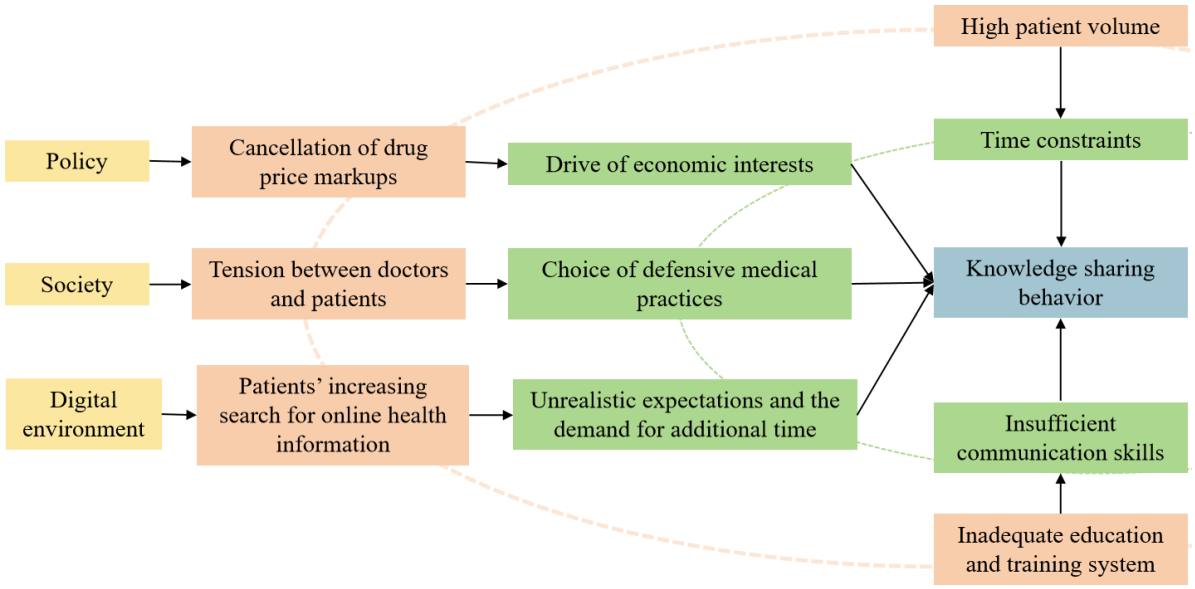

Figure 1.4 Environmental influencing factors and challenges of knowledge sharing

1.2 Research problem

Medicine is a field rich in specialized terminology and concepts (Links et al., 2019). As patients' demand for medical knowledge grows and their expectations for active participation in treatment decisions rise, the importance of knowledge sharing between doctors and patients has become more pronounced (Guo et al., 2022). A higher level of patient health literacy and a good doctor-patient relationship contribute to effective chronic disease management. Doctors serve as authoritative providers of knowledge and long-term health management guides for patients, and play a crucial role in establishing doctor-patient trust. However, Chinese chronic disease doctors face numerous challenges when it comes to knowledge sharing.

These challenges include an economic interest orientation driven by the policy environment, strained doctor-patient relationships resulting from the social environment, unrealistic patient expectations caused by the online environment, and time pressures faced by doctors during consultations. In China, the commercialization of public hospitals and defensive medical practices may discourage doctors from prioritizing knowledge sharing. At the same time, the wide spread of online health information has empowered patients, but may also lead to patients' skepticism toward the information provided by doctors. These pressures—stemming from policy, society, digital environments, and patients—can all affect the knowledge sharing behavior of chronic disease doctors. Furthermore, doctors are not inherently equipped with excellent communication skills (Ahmed et al., 2022). Due to constrained time for diagnosis and treatment (Tu et al., 2019) and insufficient communication training (Bai et al., 2019; Blatt et al.,

2009), even if chronic disease doctors are willing to engage in knowledge sharing, they may simplify or omit important details when conveying information about treatment plans, medication adjustments, and expected outcomes. In addition, doctors' role perception and professional responsibility in knowledge sharing are crucial during knowledge transfer (Brand & Timmons, 2021). Some doctors believe that excessive sharing of medical records may cause patients' anxiety (Fritz et al., 2019). Others may consider that sharing knowledge could undermine their power and authority (Gider et al., 2015). These challenges may affect the knowledge sharing behavior of chronic disease doctors and could even impact the long-term health management of their patients.

The facilitators, processes, and outcomes of knowledge sharing are interconnected and interact in a linear manner (Yeboah, 2023). During clinical encounters, enhancing patient health literacy is the final step in realizing the effective transmission of medical knowledge and its adoption by patients (Wahl et al., 2022). Furthermore, under the simple logic of "the more you tell me, the more I trust you", information sharing can be conducive to enhancing doctor-patient trust (Xu & He, 2019). However, in the Chinese context, it remains unclear whether knowledge sharing by chronic disease doctors benefits the improvement of patient health literacy and the strengthening of doctor-patient trust. Moreover, research on doctors' behavior should not only consider the characteristics of their profession and industry but also the specificity of the Chinese healthcare environment. In China, doctors face high levels of work stress (Tu et al., 2019) and job burnout (Peleg et al., 2000), and they encounter various external disruptions and interruptions during consultations. These factors, closely related to job effort, may not only limit the realization of knowledge sharing behavior among chronic disease doctors but also affect the subsequent feedback and evaluation regarding patient health literacy.

1.3 Research objectives

With the increasing burden of chronic diseases and the higher demand for improving patient health literacy, doctors, as the main transmitters of medical knowledge, play an indispensable role in chronic disease management, where knowledge sharing by these doctors has become a crucial factor. Selecting chronic disease doctors as the research subjects offers advantages in studying knowledge sharing between doctors and patients. In comparison, doctors in other specialties may primarily engage in short-term doctor-patient interactions, with reduced continuity and depth of knowledge sharing. Meanwhile, improving patient health literacy is an urgent task in chronic disease management, and fostering doctor-patient trust is a long-term

common goal. However, within the specific medical environment and socio-cultural context of China, chronic disease doctors face many challenges and obstacles during knowledge sharing. These challenges include external environmental pressures, difficulties in time management, insufficient communication skills, and high work intensity. They may not only influence doctors' knowledge sharing behavior but also indirectly affect the outcomes of their knowledge-sharing efforts. Therefore, **this research aims to analyze the key factors influencing knowledge sharing behavior among Chinese chronic disease doctors, explore how knowledge sharing affects patient health literacy and doctor-patient trust, and examine the moderation of job effort therein**. The findings will provide practical suggestions for improving doctors' knowledge sharing practices.

1.4 Research questions

Doctors' intention to share knowledge with patients may be influenced by cultural and social factors (Brand & Timmons, 2021; Lesser et al., 2010). China has its unique medical decision making cultures and values (Huang et al., 2015; Yang et al., 2022), and Chinese doctors' attitudes toward knowledge sharing with patients may vary. Furthermore, doctors in China face pressures from the economy, society, and online health information (Lu et al., 2016; Tao et al., 2020). Additionally, they also encounter challenges in terms of time management and communication skills, which affect their ability to quickly and effectively share knowledge (Du et al., 2022; Li & Xie, 2013). These deductions align with the concepts of attitudes, subjective norms, and perceived behavioral control in the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991). While previous studies have shown that TPB can effectively predict knowledge sharing behavior among employees (Ryu et al., 2003), it remains unclear whether the theory can also be applied to predict doctors' knowledge sharing behavior.

TPB not only focuses on the formation of behavioral intentions and the implementation of behaviors but also considers the feedback effects that may arise after the behavior is performed. These feedback effects, in turn, influence individuals' attitudes, subjective norms, and perceived behavioral control, creating a dynamic feedback loop (Ajzen, 2020). Thus, exploring the outcomes of knowledge sharing behavior can be considered an extension of the TPB framework. Some independent studies suggest that doctors' knowledge sharing behavior may contribute to a harmonious doctor-patient relationship (Mao et al., 2021) and improve patient health literacy (Brand & Timmons, 2021), while bridging the health literacy gap between doctors and patients may also enhance doctor-patient trust (Feifer, 2003). However, the relationship between doctors'

knowledge sharing behavior, patient health literacy, and doctor-patient trust in the context of chronic disease management has not yet been fully established. In addition, the impact of job effort, closely related to chronic disease doctors' work intensity in the Chinese context, needs to receive more attention.

This study attempts to answer the following research questions (RQs):

RQ1: What is the status quo of chronic disease doctors' attitudes toward knowledge sharing (ATT), subjective norms for knowledge sharing (SN), perceived behavioral control for knowledge sharing (PBC), behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), perceived patient health literacy (PPHL), doctor-patient trust (DPT), and job effort (JE)?

RQ2: What is the relationship between chronic disease doctors' attitudes toward knowledge sharing (ATT), subjective norms for knowledge sharing (SN), perceived behavioral control for knowledge sharing (PBC), behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), perceived patient health literacy (PPHL), doctor-patient trust (DPT), and job effort (JE)?

RQ3: How does chronic disease doctors' job effort (JE) moderate the relationship between behavioral intention to knowledge sharing (BI) and actual behavior of knowledge sharing (AB), as well as between actual behavior of knowledge sharing (AB) and perceived patient health literacy (PPHL)?

1.5 Research framework and main content

This thesis is divided into six chapters: introduction, literature review, research methods, results, discussion, and conclusions and prospects. The main content of each chapter is outlined as follows.

Chapter 1: Introduction

This chapter presents the research background, research problem, research objectives, and research questions.

Chapter 2: Literature Review

This chapter first provides a review of the literature on TPB, knowledge sharing, health literacy, doctor-patient trust, and job effort. Based on the theoretical framework and existing literature, we propose the research hypotheses and theoretical model.

Chapter 3: Research Methods

This chapter introduces the composition of the questionnaire, the implementation process,

and quality control measures. It also presents the results of reliability analysis, validity analysis, and common method bias tests.

Chapter 4: Results

This chapter presents the results of descriptive statistics, correlation analysis, difference analysis, and structural equation modeling.

Chapter 5: Discussion

This chapter discusses the research findings and analyzes the underlying reasons for the obtained results.

Chapter 6: Conclusions and Prospects

This chapter summarizes the research conclusions, key findings, theoretical contributions, managerial implications, limitations of the study, and suggestions for future research.

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Chapter 2: Literature Review

This chapter first reviews the literature on the Theory of Planned Behavior (TPB), knowledge sharing, health literacy, doctor-patient trust, and job effort. Based on the theoretical framework and previous literature, we will put forward the research hypotheses and theoretical model.

2.1 Theory of Planned Behavior (TPB)

2.1.1 Origin and development of the theory

Ajzen has long been dedicated to the refinement, promotion, and development of TPB. The Theory of Reasoned Action (TRA), proposed by Ajzen and Fishbein (1980), suggests that an individual's behavioral intention determines actual behavior, and that behavioral intention is influenced by the individual's attitudes and subjective norms. Subsequently, Ajzen (1985) introduced the TPB, adding the variable of perceived behavioral control to TRA. TPB suggests that behavioral intention is influenced jointly by individuals' attitudes, subjective norms, and perceived behavioral control. Then, Ajzen (1991) further elaborated on the key aspects of TPB, including the impact of behavioral beliefs, normative beliefs, and control beliefs on attitudes, subjective norms, and perceived behavioral control. In the same year, he proposed the Expected Value Theory, integrating concepts from the Expectancy-Value Theory and TPB. This theory posits that behavioral attitudes are influenced not only by behavioral beliefs but also by the evaluation of behavioral outcomes (Ajzen, 1991). Subsequently, Ajzen (2002a) further revealed that perceived behavioral control consists of two components: perceived autonomy (the difficulty of performing a specific behavior) and perceived controllability (the degree to which the individual feels they can execute the behavior). At this stage, Ajzen's main contribution was the development of TPB and the identification of its core elements.

Further, Ajzen (2005) summarized and evaluated the development and application of TPB, pointing out its limitations and proposing future research directions. Ajzen (2002a) explored the differences and relationships between perceived behavioral control, self-efficacy, and locus of control. Fishbein and Ajzen (2009) reviewed the evolution from TRA to TPB and the progress made by these theoretical frameworks in explaining behavior. Ajzen (2011) responded to critiques of TPB from the academic community, defending and clarifying some of the core

concepts of TPB. Subsequently, Ajzen (2015) reaffirmed the enduring relevance of TPB, addressing misunderstandings within the academic community and providing guidance for its future development and application. At this stage, Ajzen further enriched and refined TPB, ensuring the theory's continued academic and practical impact.

La Barbera and Ajzen (2020) found that in the prediction of behavioral intentions, stronger perceived behavioral control may enhance the relative importance of attitudes while potentially diminishing the relative importance of subjective norms. Ajzen (2020) provided answers and discussions regarding some common issues within TPB. In 2022, Ajzen's team further explored new advancements in the conceptualization, evaluation, and modeling of TPB constructs (Hagger et al., 2022). At this stage, Ajzen continued to explore new insights into TPB, establishing it as one of the most important theoretical models in the field of behavioral science.

Behavioral intention can directly predict actual behavior and is determined by individuals' attitudes, subjective norms, and perceived behavioral control. The formation of behavioral intention is determined by an individual's motivation to perform the behavior in light of alternative choices and current goals (Ajzen & Kruglanski, 2019). Generally, the stronger the attitudes, subjective norms, and perceived behavioral control, the more intense the individual's intention to perform the behavior (Ajzen, 2002a), while behavioral intention is considered the direct antecedent of actual behavior (Armitage & Conner, 2001; Fishbein & Ajzen, 2009). When there is limited knowledge of control over actual behavior, perceived behavioral control can serve as an alternative indicator for predicting behavior. In addition, if an individual believes they have sufficient resources, opportunities, and ability to execute a behavior, they may directly take action (Ajzen, 2002a). TPB has received widespread attention in fields such as health science, environmental science, business and management, and education research, and has become one of the most widely applied theories in the social and behavioral sciences (Ajzen, 2020).

When explaining and understanding healthcare professionals' behavior, TPB is one of the most commonly applied theories (Godin et al., 2008; Perkins et al., 2007). However, at present, TPB is more commonly applied to knowledge sharing among healthcare professionals and shared decision making, health education, and communication between doctors and patients, with fewer studies focusing on knowledge sharing between doctors and patients. Given the close relationship between doctor-patient knowledge sharing and shared decision making, health education, and communication, this study will draw on findings of existing research on shared decision making, health education, and communication to further explore the influencing factors and outcomes of knowledge sharing between doctors and patients.

2.1.2 Key features of the theory

TPB suggests that behavioral intention is a strong predictor of an individual's behavior (Ajzen & Fishbein, 1980), and that behavioral intention is determined jointly by attitudes, subjective norms, and perceived behavioral control (Perkins et al., 2007). The more positive the attitudes, the more supportive the subjective norms, and the stronger the perceived behavioral control, the greater the intention to perform the behavior (Bosnjak et al., 2020). Under conditions of adequate actual control, behavioral intention directly determines the behavior (Ajzen, 1985). However, with non-full volitional control, the execution of the behavior is constrained by control conditions such as the individual's ability, available opportunities, and accessible resources. Personality, environmental, and demographic variables may influence behavioral intention through attitudes, subjective norms, and perceived behavioral control (Perkins et al., 2007). Many studies have also incorporated additional variables and theoretical models to enhance the explanatory power and applicability of the TPB (Bosnjak et al., 2020). See Figure 2.1 for the model of TPB.

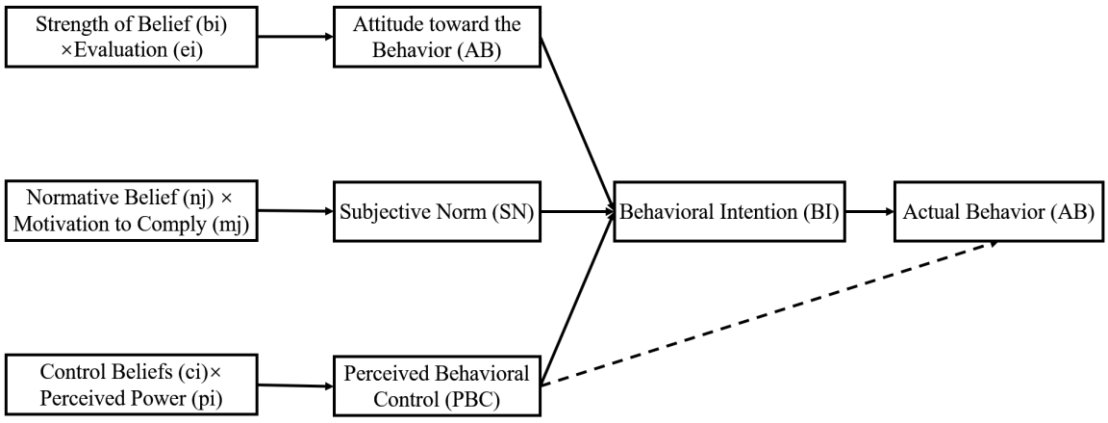

Figure 2.1 Model of Theory of Planned Behavior (TPB)

Source: Ajzen (1991)

2.1.3 Key variables in the theory

(1) Attitudes

Attitudes refer to an individual's positive or negative evaluation of performing a specific behavior (Ajzen, 1985). Individuals possess a range of beliefs about the possible outcomes of the behavior, which are referred to as behavioral beliefs (Fishbein & Ajzen, 1975). Behavioral beliefs include the strength of belief (b) and the evaluation of the behavior's outcome (e). Both the strength of behavioral beliefs and the evaluation of the outcome jointly shape individuals' attitudes toward the behavior. This relationship can be represented as the function $AB \propto \sum b_i e_i$,

where b_i represents the strength of different beliefs, and e_i represents the weight of each specific belief. Attitudes are the sum of all beliefs weighted by their corresponding values.

When an individual evaluates a behavior positively, they develop a positive attitude toward the behavior, while negative evaluations lead to a negative attitude. TPB includes both the instrumental components of attitudes (e.g., useful-harmful, valuable-worthless) and the affective components (e.g., like-dislike, pleasant-unpleasant) (Bagozzi et al., 2001). For some individuals, subjective norms may be the most important determinant of their behavioral intention, while for others, attitudes may be the primary factor in determining intention (Perkins et al., 2007). However, the predictive power of these variables in Chinese chronic disease doctors' knowledge sharing behavior is still unclear.

(2) Subjective norms

Subjective norms refer to the social pressure an individual perceives when deciding whether to perform a specific behavior. This perceived pressure is often exerted by the social relationships within the individual's social structure. Similar to attitudes, subjective norms are influenced jointly by normative beliefs (n) and motivation to comply (m). Normative beliefs refer to an individual's perception about the expectations of significant others or groups toward a specific behavior, while motivation to comply refers to an individual's inherent intention to conform to these expectations. This relationship can be represented as the function $SN \propto \sum n_j m_j$.

Normative Focus Theory posits that norms consist of three main dimensions: injunctive norms, descriptive norms, and personal norms. Injunctive norms refer to what significant others expect an individual to do; descriptive norms refer to what significant others themselves do; and personal norms refer to what an individual believes they should do (Reno et al., 1993). There is a strong correlation between descriptive norms and behavioral intention ($r = .7$) (Rivis & Sheeran, 2017), while personal norms can significantly predict negative social behaviors (Kiriakidis, 2008).

(3) Perceived behavioral control

Perceived behavioral control refers to an individual's perceived ease or difficulty in performing a particular behavior of interest (Ajzen, 1991). The stronger the perceived behavioral control, the more controllable the factors influencing the behavior, and the higher the likelihood that the behavior will be executed (Kraft et al., 2005). Similar to attitudes, the components of perceived behavioral control include control beliefs (c) and perceived power (p) (Jha et al., 2022). Control beliefs refer to an individual's perception of the possible factors facilitating or hindering the execution of the behavior (Godin et al., 2004; Kushner & Mechanick, 2016). Perceived power refers to the individual's perception of the strength of these

factors in influencing the actual behavior. This relationship can be expressed as the function $PBC \propto \sum c_i p_i$.

Perceived behavioral control is related to an individual's confidence in his/her ability to perform the behavior and the perceived control over the behavior. The first factor reflects individuals' internal control beliefs, while the second reflects external control beliefs. Ajzen tends to consider the first factor as reflecting individuals' self-efficacy beliefs and the second as reflecting control beliefs, and he has previously referred to these factors as self-efficacy and control (Ajzen, 2002a). In fact, these two perspectives are similar. Internal factors refer to an individual's confidence in their skills, knowledge, and ability to identify and obtain information, while external factors refer to an individual's ability to control time pressure, costs, and resources (Kraft et al., 2005).

(4) Behavioral intention

Behavioral intention refers to an individual's inherent motivation to perform a specific behavior, reflecting how much effort and time the individual is willing to invest in executing the behavior (Ajzen, 1991). Although most studies have found a strong relationship between behavioral intention and actual behavior (Gao et al., 2008; Kim & Lee, 2023), behavioral intention does not always accurately predict the execution of behavior (Perkins et al., 2007). When an individual perceives full control over whether to perform a specific behavior, behavioral intention can directly predict the actual behavior (Ajzen, 1991). Hence while strong behavioral intention is usually an antecedent of behavior execution, it is not the only determining factor.

(5) Actual behavior

Actual behavior refers to the behavior that an individual actually exhibits in a specific situation. It is the final outcome within the framework of TPB. The stronger the behavioral intention, the more likely the behavior is to be carried out (Ajzen, 1991). However, actual behavior can be affected by immediate situational factors (e.g., unexpected events), external constraints (e.g., limited time, money, or resources), and various other factors that may prevent individuals from acting in line with their intentions (Ajzen & Schmidt, 2020). Therefore, the nature of the goal, the foundation of the intention, and the characteristics of the intention all influence the likelihood of realizing the intended behavior (Sheeran & Webb, 2016). In addition, actual behavior is not static and is influenced by individual life experiences, changes in the social environment, and the learning process. If individuals are to initiate new behaviors or change behaviors that are no longer seen as desirable, forming the intention to change is crucial (Sheeran & Webb, 2016). Through education, training, incentives, or interventions, individuals

can be guided to change negative behaviors and develop positive ones.

2.2 Knowledge sharing

2.2.1 Concept of knowledge sharing

Among the various processes of knowledge management, knowledge sharing is the most important component. Bartol and Srivastava (2002) posit that knowledge sharing encompasses the sharing of organization-related information, views, suggestions, and expertise among individuals. However, this concept of knowledge sharing is somewhat broad and general. According to Nonaka (1994), knowledge can be divided into two different types: explicit knowledge and tacit knowledge. Specifically, explicit knowledge often presented in symbolic or written form, while tacit knowledge is often not expressed in this way (Lee, 2001). In the medical field, the knowledge shared between doctors and patients includes both explicit knowledge (e.g., test results) and tacit knowledge (e.g., personal experience), with tacit knowledge being the dominant form.

Knowledge sharing not only involves the content of the exchange but also the implementation of behavior, and both are indispensable. In an early stage, Hendriks (1999) defined knowledge sharing as an individual behavior of disseminating acquired knowledge to others. In addition, knowledge sharing was considered not limited to behavior between individuals. Lee (2001) extended the concept of knowledge sharing from individual actions to include behaviors at the personal, group, and organizational levels, defining knowledge sharing as the activity of transferring or disseminating knowledge (both tacit and explicit) from one person, group, or organization to another. In summary, knowledge sharing behaviors have common characteristics, such as the actors, the resource, and the method, and can occur in various organizational and social relationships.

Previous studies on knowledge sharing have mainly focused on consumers (Y. Li et al., 2022), students (Han et al., 2020; Moghavvemi et al., 2017), and employees (Olayemi & Olayemi, 2021; Sudibjo & Prameswari, 2021), among others. Compared to other fields, the healthcare sector has a higher density of knowledge both at the individual and organizational levels. Knowledge sharing in the healthcare field includes exchanges among doctors within the same specialty (Almashmoum et al., 2023), between doctors from different specialties (Anthoine et al., 2014; Lisy et al., 2020), between doctors and nurses (Mamo Mulate & Gojeh, 2020), among nurses (Kim & Park, 2015), and between doctors and other stakeholders related

to healthcare services (Lee & Hong, 2014; Ryu et al., 2003). In doctor-patient interactions, doctors and patients constitute the primary stakeholders. However, knowledge sharing between doctors and patients has received relatively little attention. (Bryant et al., 2012) define knowledge sharing in healthcare services as the transfer of knowledge between key producers of service (e.g., doctors and patients).

Despite limited research on knowledge sharing between doctors and patients, the definitions of knowledge sharing in the healthcare field provide important references for describing the concept of knowledge sharing between doctors and patients. The primary channel for knowledge sharing is face-to-face interaction (Olayemi & Olayemi, 2021). Chronic disease outpatient clinics provide favorable conditions for knowledge sharing between doctors and patients. During the first consultation for chronic disease patients, doctors not only bear the responsibility of explaining the causes of the disease, the procedures for examination, and the purposes, but also need to develop personalized treatment strategies, including medication regimens and expected disease progression. Additionally, regular outpatient follow-ups are the most prominent feature of chronic disease management. During long-term follow-up, doctors need to monitor and observe changes in the patient's health condition and adjust the treatment plans accordingly, including but not limited to modifying medication regimens, arranging necessary supplementary examinations, and reassessing treatment goals. Therefore, in this study, doctors' knowledge sharing refers to the process in which chronic disease doctors convey information to patients in a clear and understandable manner within the consultation room. This includes explanations of disease causes, treatment plans, examination purposes, medication usage, and the long-term outcomes the disease may bring.

2.2.2 Factors influencing knowledge sharing

The knowledge sharing behavior is influenced by a variety of motivational and environmental factors. Both extrinsic and intrinsic motivations jointly stimulate the knowledge sharing behavior. Additionally, environmental factors, from the social and cultural background on a macro level to team atmosphere on a micro level, play a role in shaping an individual's knowledge sharing behavior.

The extrinsic motivation for knowledge sharing stems from the beliefs formed based on the cost-benefit analysis (Osterloh & Frey, 2000). Reciprocity emphasizes the social norm of balancing "giving" and "receiving" (Gouldner, 1960; Walster et al., 1973). Chang and Chuang (2011) argue that interpersonal reciprocity motivation positively affects employees' attitudes and intention to share knowledge. When individuals receive valuable knowledge from a

knowledge provider, they are also obligated to transfer equivalent knowledge back to the provider (Schulz, 2001). Furthermore, reputation is also one of the factors that motivate employees to engage in knowledge sharing (Hung et al., 2011). Within an organization, individuals may be willing to share knowledge to enhance their reputation (Davenport & Prusak, 1998). Moreover, research has confirmed that employees who perceive potential rewards (e.g., promotions and incentives) are more motivated to share knowledge (Chumg et al., 2015). Therefore, when individuals perceive that sharing knowledge will lead to positive external feedback (e.g., reciprocity, rewards, promotion, or reputation), they are likely to view such behavior as aligning with social expectations and organizational norms.

The knowledge sharing behavior, through continuous interaction and positive feedback, can significantly stimulate intrinsic motivation. Obrenovic et al. (2020) found that altruism directly or indirectly influences tacit knowledge sharing through subjective norms. Research by Chang and Chuang (2011) showed that altruism could effectively enhance both the quality and quantity of knowledge sharing in virtual communities. For instance, altruism is considered an important factor influencing doctors' intention to share professional knowledge on online medical forums (Lin et al., 2016). In addition, knowledge providers can gain a sense of satisfaction and intrinsic enjoyment from helping others by sharing knowledge (Wasko & Faraj, 2005). As the satisfaction gained from helping others increases, individuals' knowledge sharing behavior and positive attitudes toward knowledge sharing also increase (Lin, 2007). Research has confirmed that doctors are motivated to continue sharing knowledge after experiencing increased psychological satisfaction from helping others (Zhang et al., 2022). Furthermore, when others respond in accordance with an individual's expectations, they are more likely to believe that their ideas and actions are correct. Therefore, intrinsic motivation shapes individuals' positive evaluation and emotional inclination toward knowledge sharing, which further affects their attitudes.

When individuals exhibit knowledge self-efficacy, they are more inclined to share knowledge (Kankanhalli et al., 2005). A meta-analysis has shown that the average correlation coefficient between self-efficacy and knowledge sharing behavior is $r = .28$ (Kumari & Takahashi, 2014). Shehab et al. (2023) found that knowledge self-efficacy could moderate the relationship between trust, reciprocity, and reputation with knowledge sharing behavior. However, in online communities, the relationship between self-efficacy and knowledge sharing is not always consistent (Lai & Chen, 2014; Liou et al., 2016). Zhang, Liu, Deng, et al. (2017) found that in online health communities, healthcare professionals' self-efficacy was significantly positively associated with their intention to share knowledge. However, this

relationship was not significant among general users. In the knowledge sharing process, individuals with higher self-efficacy are more likely to believe in their ability to successfully transfer knowledge to others. This belief makes them more willing to share knowledge and put it into practice. However, the role of self-efficacy may differ across different environments and groups, and further research is needed to explore these variations.

Environmental factors play a crucial role in shaping individual behavior, especially in complex social and organizational systems. At the societal level, in Western cultural contexts, professionals' reluctance to share knowledge is driven by rational choice (Akgün et al., 2017). However, in many East Asian countries, knowledge sharing intentions of governments, businesses, families, and individuals are influenced by Confucian values (Kwon, 2007). At the organizational level, Robertson and O'Malley Hammersley (2000) suggest that work environments advocating egalitarianism and autonomy are conducive to knowledge sharing and creation within organizations. In participatory management, both employees and managers can equally participate in information processing, decision making, and problem-solving (Wagner, 1994). Moreover, at the team level, a team atmosphere with high task interdependence will facilitate knowledge sharing among members (Ahmad & Karim, 2019). In addition, knowledge diversity can motivate team members to share their distinctive perspectives and experiences (Harrison & Klein, 2007), promote interaction of different viewpoints (Sung & Choi, 2019), and reconfigure existing ideas (Hoever et al., 2012). Therefore, factors at both the macro societal level and the micro team level jointly influence knowledge sharing behavior.

Previous research has shown that both extrinsic and intrinsic motivations are antecedents of attitudes, subjective norms, or perceived behavioral control (Ahmad et al., 2023; Javaid et al., 2020; Ong et al., 2023). These findings have been confirmed in some studies in the field of knowledge sharing, that is, motivation may affect the behavioral intention to knowledge sharing by influencing attitudes, subjective norms, or perceived behavioral control (Obrenovic et al., 2020). Furthermore, the positive feedback loop between motivation and knowledge sharing is consistent with TPB. In TPB, feedback received after behavior implementation can influence individuals' attitudes, social norms, and perceived behavioral control (Ajzen, 2020). Thus, attitudes, subjective norms, and perceived behavioral control may mediate the positive relationship between motivation and knowledge sharing. Additionally, a supportive work environment is closely related to knowledge sharing (Ramayah et al., 2013). When studying individuals' knowledge sharing behavior, it is crucial to consider the environmental factors. For instance, time pressure is a major factor that limits individuals' knowledge sharing (He & Wei, 2009; Karamitri et al., 2017). Therefore, in the current healthcare environment and management

system in China, doctors' behavioral intention to knowledge sharing may be directly influenced by their attitudes, subjective norms, and perceived behavioral control.

2.2.3 Impact of knowledge sharing

Knowledge sharing has positive effects at the individual, team, and organizational levels, but it also comes with potential negative effects, such as time waste and increased pressure. Therefore, a comprehensive evaluation of its overall impact is needed.

Knowledge sharing can influence individual, team, and organizational performance and innovation behavior (Ahmad & Karim, 2019; Li et al., 2021). At the individual level, there is a significant positive relationship between the knowledge sharing behavior and individuals' innovation behavior (Derin et al., 2022; Yasir et al., 2023). By sharing knowledge, employees can leverage collective wisdom and expert opinions to improve performance (Rezaei et al., 2017). At the team level, knowledge sharing is an effective knowledge management tool that influences team creativity (Bodla et al., 2018; Ratasuk & Charoensukmongkol, 2020). Knowledge sharing can facilitate interaction and reciprocity (Radaelli et al., 2014) and help to establish trust between team members (Alsharo et al., 2017). At the organizational level, the knowledge sharing behavior can promote the organization's innovation performance (Giampaoli et al., 2017; Zhang & Min, 2022). Furthermore, knowledge sharing is also closely related to work satisfaction (Jiang, 2014) and well-being (Zhu, 2017).

However, knowledge sharing is not always beneficial (Mahnke et al., 2009), as knowledge sharing may lead to time waste (Ahmad, 2017; Haas & Hansen, 2007) and increase pressure and burnout for the knowledge providers (Ahmad & Karim, 2019). On the one hand, the time and effort spent by individuals in searching, screening, and integrating knowledge may exceed the value derived from it. On the other hand, individuals may need to invest additional time and effort to share knowledge in addition to completing their own tasks, which could increase their workload. As a result, previous research has primarily focused on the financial outcomes of knowledge sharing (Yeboah, 2023). However, the non-financial outcomes are also worthy of attention (Zhang & Min, 2022). Thus, the potential negative outcomes of knowledge sharing may hinder individuals' actual behavior.

The facilitators, processes, and outcomes of knowledge sharing are interconnected and influence each other (Yeboah, 2023). Knowledge sharing seems to be a major determinant of improved work performance (Kang et al., 2008) and a key factor in enhancing creative problem-solving abilities (Carmeli et al., 2013). Regarding the positive impacts of knowledge sharing in the healthcare environment, at the individual level, doctors' knowledge sharing may directly

benefit patients' health outcomes, such as improving patient health literacy. From a team perspective, doctors' knowledge sharing may have a profound impact on promoting doctor-patient trust. Furthermore, within the framework of TPB, the outcomes of individuals' behavior will in turn influence their attitudes toward the behavior, perceived social norms, and perceived behavioral control (Ajzen, 2020). Therefore, when exploring the antecedents of doctors' knowledge sharing behavior, it is necessary to consider the feedback effects of outcome variables, which aligns with the feedback received by chronic disease doctors during long-term follow-ups. It can also help to verify the feedback mechanism in the TPB model.

2.2.4 Application of TPB in knowledge sharing among healthcare professionals

TPB is a psychological model that can be used to predict knowledge sharing behavior within organizations (Nguyen et al., 2019). Some previous studies have already applied the TPB framework to examine knowledge sharing among healthcare professionals. For example, Ryu et al. (2003) surveyed 286 doctors from 13 tertiary hospitals in Korea and found that subjective norms directly and, through attitudes, indirectly influenced doctors' intention to knowledge sharing, with the strongest total effect. Bhatti et al. (2014) studied doctors in private and public hospitals in Pakistan and found that attitudes had the most significant impact on behavioral intention to knowledge sharing. Aktharsha and Anisa (2012), using the TPB framework, explained 63% of the variance in knowledge sharing behavior among nurses in private hospitals in India, with subjective norms being the least influential factor of behavioral intention to knowledge sharing. Mafabi et al. (2017) conducted a survey among nurses and doctors in Uganda and found that behavioral intention to knowledge sharing fully mediated the influence of attitudes, subjective norms, and perceived behavioral control on actual behavior, but there was no direct relationship between perceived behavioral control and actual behavior. In these studies, the three core components of the TPB model showed different effects in explaining the knowledge sharing behavior among healthcare professionals.

Some previous studies on knowledge sharing have incorporated additional variables to the TPB model. Alhalhouli et al. (2014) analyzed the factors influencing the knowledge sharing behavior among stakeholders in Jordanian hospitals and found that education level, perceived reciprocal benefits, perceived loss of knowledge power, and ease of use of tools and technology were antecedents to attitudes, leadership was an antecedent to subjective norms, and perceived service availability and perceived awareness were antecedents to perceived behavioral control. Building on previous research, Ryu et al. (2003) further confirmed that the expected tacit rewards had a significant positive effect on doctors' attitudes toward knowledge sharing, and

that autonomy, management support, and trust significantly affected subjective norms and perceived behavioral control for knowledge sharing (Bhatti et al., 2014). Samad (2018) integrated TPB with equity theory and found that distributive fairness moderated the relationship between attitudes and knowledge sharing and between subjective norms and knowledge sharing among nurses. Opesade and Alade (2020) examined the factors influencing knowledge sharing behavior among Nigerian pharmacists and found positive relationships between attitudes, subjective norms, perceived behavioral control, openness, and agreeableness with knowledge sharing behavior. These studies have expanded the TPB model by incorporating additional variables, enriching its theoretical explanations.

Some studies have adjusted or replaced the basic elements of the TPB model. For example, Li and Lowe (2016) conducted semi-structured interviews with community hospital doctors and found that when doctors formed positive attitudes toward knowledge sharing, received external encouragement from patients, colleagues, other medical professionals, and payers, and gained necessary infrastructure support, they were more likely to engage in knowledge sharing. By creating a citizen advisory panel in a Canadian hospital, Chan et al. (2023) collected opinions and found that behavioral intention to knowledge sharing was positively associated with subsequent knowledge-seeking behaviors after group meetings, enthusiasm and anxiety were positively associated with subsequent behavioral intention to knowledge sharing, and knowledge sharing in group meetings was positively associated with subsequent behavioral intention to knowledge sharing outside of the group. Balozi et al. (2016), assuming personal capabilities as perceived behavioral control, and career promotion and personal values as attitudes toward specific behaviors, confirmed the impact of these three variables on the knowledge sharing behavior of healthcare professionals (doctors and nurses) in Tanzania. Singh et al. (2018) constructed an extended “attitude-behavior” framework based on the TRA, TPB, and Technology Acceptance Model, and found that knowledge self-efficacy and enjoyment in helping others significantly influenced attitudes toward knowledge sharing. These studies empirically demonstrate the broad applicability and stability of TPB in explaining knowledge sharing in the healthcare sector.

In summary, some studies have directly applied the TPB framework to predict the knowledge sharing behavior among healthcare professionals. Other studies have expanded or streamlined the model by replacing variables or adding distal antecedents to enhance its predictive power on knowledge sharing behavior among healthcare professionals. Therefore, the TPB framework has strong explanatory power and applicability regarding knowledge sharing behavior among healthcare professionals (see Table 2.1).

Table 2.1 TPB literature on knowledge sharing among healthcare professionals

No.	Researcher(s) & year	Products of study	Additional variable(s) to the TPB model	Dependent variable	Country
1	Ryu et al. (2003)	Physicians' knowledge sharing	None	Physicians' intention to knowledge sharing	Korea
2	Ryu (2004)	Physicians' knowledge sharing	Expected overt rewards; expected associations; expected contributions; autonomy; trust; management support	Physicians' knowledge sharing behavior	Korea
3	Aktharsha and Anisa (2012)	Nurses' knowledge sharing	None	Nurses' knowledge sharing behavior	India
4	Alhalhouli et al. (2014)	Hospital's stakeholders' knowledge sharing	Education level; perceived reciprocal benefits; perceived loss of knowledge power; perceived reputation enhancement; ease of use of tools and technology; leadership; organizational culture; service availability; perceived awareness	Hospital's stakeholders' knowledge sharing	Jordan
5	Bhatti et al. (2014)	Physicians' knowledge sharing	None	Physicians' intention to share knowledge	Pakistan
6	Balozi et al. (2016)	Healthcare professionals' knowledge sharing	Individual capabilities; career advancement; personal values;	Healthcare professionals' knowledge sharing	Tanzania
7	Li and Lowe (2016)	Physicians' knowledge sharing	Time constraint; professionalism;	Physicians' knowledge sharing behavior	America
8	Mafabi et al. (2017)	Physicians' and nurses' knowledge sharing	None	Physicians' and nurses' knowledge sharing behavior	Uganda
9	Singh et al. (2018)	Healthcare professionals' knowledge sharing	Perceived seeking effort; perceived usefulness; trust; expected reciprocal benefits; knowledge self-efficacy; enjoyment in helping others;	Health care professional's knowledge sharing	India
10	Samad (2018)	Nurses' knowledge sharing	None	Nurse's knowledge sharing behavior	Malaysia
11	Septiani et al. (2020)	Nurses' knowledge sharing	None	Nurse's intention to share knowledge	Indonesia
12	Opesade and Alade (2020)	Pharmacists' knowledge sharing	Extraversion; neuroticism; openness; agreeableness; conscientiousness;	Pharmacist's knowledge sharing behavior	Nigeria
13	Chan et al. (2023)	Hospital's stakeholders'	Enthusiasm; anxiety; knowledge sharing within	Hospital's stakeholder's	Canada

No.	Researcher(s) & year	Products of study	Additional variable(s) to the TPB model	Dependent variable	Country
		knowledge sharing	group; task knowledge; Organizational knowledge; relative knowledge;	knowledge sharing behavior (beyond group)	

2.2.5 Application of TPB in shared decision making, communication, and health education

Knowledge sharing between doctors and patients is closely related to shared decision making (Makoul & Clayman, 2006), health education (Paul et al., 2023), and communication (King & Hoppe, 2013). Sophie Desroches and France Légaré are representative scholars driving the integration of shared decision making into clinical practice. Perceived behavioral control may be the only significant predictor of dietitians' behavioral intention to shared decision making (Vaillancourt et al., 2015). Deschênes et al. (2013) further found that perceived behavioral control, subjective norms, and moral norms are significant predictors of intentions to provide dietary treatment options, while perceived behavioral control, attitudes, and professional norms are significant predictors of intentions to help patients clarify their values and preferences. The intention of healthcare professionals to engage in interprofessional shared decision making is also influenced by cognitive attitudes, subjective norms, and perceived behavioral control (Légaré et al., 2013). Screening for decisional conflict is a key ability in shared decision making, whereas attitudes, subjective norms, and perceived behavioral control all influence the intention to screen for decisional conflicts (Légaré et al., 2007). Légaré et al. (2011) found that, unlike the factors influencing women's engagement, only attitudes and the views of significant others influenced family physicians' intention to engage in shared decision making for prenatal screening for Down syndrome. Decision aids are one of the essential tools for achieving shared decision making (Stacey et al., 2017). Abbasgholizadeh Rahimi et al. (2018), collaborators of France Légaré, found that attitudes, self-identity, descriptive norms, moral norms, and anticipated regret were related to healthcare professionals' intention to use decision aids for prenatal screening. Research on shared decision making in the context of the Chinese healthcare environment is relatively limited. D. Wang et al. (2022) conducted a study on shared decision making behavior between doctors in primary healthcare institutions and patients with acute respiratory infections and found that perceived behavioral control was not a significant predictor of doctors' behavioral intention or actual behavior.

In healthcare settings, communication and decision making are equally important (Makoul & Clayman, 2006). Kiestra et al. (2020) found that, in addition to self-efficacy and attitudes, only the perceived norms (among the three types of norms) regarding patients' expectation for

doctors to discuss lifestyle was significantly related to general practitioners' behavior of lifestyle counseling. Subsequently, De Munnik, Vervoort, et al. (2017) further confirmed, based on semi-structured focus group interviews, that attitudes were the only significant factor influencing nurses' behavioral intention to discuss sexual risks. Roberto et al. (2011), based on both TPB and the TRA, examined pediatricians' behavior of encouraging parents to vaccinate their teenage daughters for the Human Papillomavirus (HPV) and found that perceived behavioral control only slightly improved the overall predictive power of TRA. In a study with a different subject (substance-abuse prevention) and target audience (substance-abuse treatment providers), the TPB model showed better fit and predictive power (Roberto et al., 2014). Van Rijssen et al. (2011), based on an extended TPB framework, found that attitudes were a key determinant of insurance doctors' intention to communication, while the effects of self-efficacy and social influence (social norms and the influence of others' beliefs) were weaker. Corresponding randomized controlled trials confirmed the effectiveness of the interventions based on the TPB framework. Lin et al. (2017) found that compared to using the TPB model alone, adding perceived barriers to the model better explained healthcare professionals' behavior of providing sexual counseling services to patients with epilepsy. Additionally, the relationship between attitudes and perceived behavioral control with behavioral intention was relatively strong, while the relationship between subjective norms and behavioral intention was weaker.

Research on health education and interventions is not always theory-based (Brown, 2020). Sharifirad et al. (2015) were the first to use TPB to assess the intention of Iranian nurses to implement health literacy strategies in patient education. They found that perceived behavioral control was the strongest predictor of behavioral intention and actual behavior, while attitudes and subjective norms could not predict nurses' behavioral intention. Millstein (1996) compared TPB and the TRA and found that the TPB could better predict doctors' intention to educate adolescents about sexually transmitted diseases. (Cerbin-Koczorowska et al., 2021), using qualitative methods, found that that external conditions such as work environment and time constraints, as well as individuals' insufficient professional knowledge and interpersonal skills, could weaken pharmacists' perceived behavioral control, reducing their intention to provide health education. Kristina et al. (2019) showed that pharmacists with higher knowledge levels and self-efficacy were more likely to provide health promotion services. Walker et al. (2023) found that perceived behavioral control might be a key factor influencing nutrition professionals' adoption of dissemination and implementation science.

In summary, there has been some well-established research on the application of TPB in

promoting shared decision making, health education, and communication between doctors and patients (see Table 2.2). However, many studies focus on evaluating the effect of attitudes, subjective norms, and perceived behavioral control on behavioral intention, with less attention to the effect of behavioral intention on actual behavior. Additionally, in some studies, lack of time and communication skills is a common barrier to implementing actual behaviors. Furthermore, the influence of attitudes, subjective norms, and perceived behavioral control on behavioral intention may vary across different studies, and the relative importance of the factors influencing behavioral intention may vary depending on the type of work provided by the doctors. Therefore, more in-depth research is needed to apply the TPB model to knowledge sharing between doctors and patients.

Table 2.2 TPB literature on shared decision making, communication, and health education

No.	Researcher(s) & year	Products of study	Additional variable(s) to the TPB model	Dependent variable	Country
1	Vaillancourt et al. (2015)	Patients' and dieticians' SDM behaviors	None	Patients' and dieticians' SDM behaviors	Canada
2	Deschênes et al. (2013)	Dieticians' SDM behaviors	Professional norm; moral norm	Dieticians' SDM behaviors	Canada
3	Légaré et al. (2013)	Health professionals' engagement in an interprofessional approach to SDM	None	Health professionals' intentions to engage in an interprofessional approach to SDM	Canada
4	Légaré et al. (2007)	Physicians' screen for decisional conflict	Stress to uncertainty; reluctance to share uncertainty	Physicians' intention to screen for decisional conflict	French
5	Légaré et al. (2011)	Pregnant women's and family physicians' engagement in SDM	Self-efficacy; perceived moral correctness	Pregnant women's and family physicians' willingness to engage in SDM	Canada
6	Abbasgholizadeh Rahimi et al. (2018)	Health professionals' use in a decision aid	Advantages; disadvantages; emotions; encouragement; discouragement; incentives; facilitators barriers	Health professionals' intention to use a decision aid	Canada
7	D. Wang et al. (2022)	Physicians' SDM behavior	None	Physicians' SDM behavior; proportion engaging in SDM behavior	China
8	Kiestra et al.	General	Self-efficacy	The extent to which	Netherla

No.	Researcher(s) & year	Products of study	Additional variable(s) to the TPB model	Dependent variable	Country
	(2020)	practitioners' behavior to provide lifestyle counseling to their patients		general practitioners provide lifestyle counseling to their patients	nd
9	De Munnik, Den Daas, et al. (2017)	HIV nurses' behavior to discuss sexual risk behavior with HIV-positive men	None	HIV nurses' behavior to discuss sexual risk behavior with HIV-positive men	Netherlands
10	De Munnik, Vervoort, et al. (2017)	HIV nurses' behavior to discuss sexual risk behavior with HIV-positive men	Verbal and non-verbal communication aiming to convey Openness; Initiation of the topic; Interpersonal relation; Motivation to discuss sexual risk behavior; Time concerns; The influence of similarity	HIV nurses' behavior to discuss sexual risk behavior with HIV-positive men	Netherlands
11	Roberto et al. (2011)	Pediatricians' communication with parents about the human papillomavirus	None	Pediatricians' behavior to communicate with parents about the human papillomavirus vaccine	Not Mentioned
12	Roberto et al. (2014)	Substance-abuse treatment providers' behavior to encourage their clients to use medicated-assisted treatment	None	Substance-abuse treatment providers' behavior to encourage their clients to use medicated-assisted treatment	Not Mentioned
13	Van Rijssen et al. (2011)	Physicians' communication behavior in disability assessments	Social influence; Self-efficacy; Skills; barriers	Physicians' behavior to communicate disability assessments	Netherlands
14	van Rijssen et al. (2015)	Communication skills training for physicians	None	Not applicable	Not Mentioned
15	Lin et al. (2017)	Healthcare providers' sexual counseling in people with epilepsy	Perceived barriers	Health providers' counseling practice	Iran
16	Millstein (1996)	Physicians' delivery of preventive	None	Physicians' behavior to deliver preventive	America

No.	Researcher(s) & year	Products of study	Additional variable(s) to the TPB model	Dependent variable	Country
		services		services	
17	Kristina et al. (2019)	Pharmacists' behavior to health promotion	Self-efficacy	Pharmacists' behavior to health promotion	Indonesia
18	Walker et al. (2023)	A dissemination and implementation science training for nutrition practitioners	None	Nutrition practitioners' behavior to training	

Note: SDM = shared decision making.

2.2.6 Knowledge sharing between doctors and patients based on TPB

In the healthcare field, most studies of knowledge sharing behavior focus on healthcare professionals. However, knowledge sharing should encompass various stakeholders both within and outside the healthcare system, including healthcare professionals, patients, government officials, public health personnel, and the general public (Abidi, 2007). In building a knowledge-sharing healthcare ecosystem, doctors and patients are the most interactive and direct stakeholders. However, research on knowledge sharing between doctors and patients is relatively limited. Radaelli et al. (2015) categorized the influencing factors of doctors' knowledge sharing identified in previous literature as either facilitators or barriers of attitudes, subjective norms, and perceived behavioral control. Their study provides solid theoretical support for applying TPB as a psychological model to predict knowledge sharing behavior between doctors and patients.

Knowledge sharing is a prerequisite for implementing shared decision making. While health education is a widespread form of knowledge transmission, knowledge sharing is an integral part of communication through linguistic interaction. Shared decision making, health education, and communication are all closely related to knowledge sharing. In the above-mentioned studies on shared decision making, health education, and communication, TPB showed similar or even stronger predictive power compared to TRA (Roberto et al., 2011; Roberto et al., 2014). When explaining behaviors that are not entirely volitional, TPB may have advantages over TRA (Ajzen, 1985). Non-fully-volitional behaviors are often influenced by many external factors, such as social pressure, customs, and culture, which may not be fully controlled by individual rationality. For fully volitional behaviors, there may be no significant difference between TPB and TRA (Ajzen, 1985). However, skills and time constraints related to perceived behavioral control are often the most common factors that hinder healthcare

professionals, especially doctors, from implementing behaviors (Kiestra et al., 2020; D. Wang et al., 2022). Therefore, it is suitable to use TPB as the theoretical framework to study doctors' knowledge sharing behavior.

As mentioned earlier, attitudes, subjective norms, and perceived behavioral control are all potential predictors of shared decision making, health education, and communication behavior. However, these factors show variation in their predictive power across different studies. Some studies even found weak or insignificant effects. For example, in some studies, perceived behavioral control is found to be the most significant or even the only influencing factor of behavioral intention (Cafiero, 2013; Vaillancourt et al., 2015). However, in some other studies, perceived behavioral control was not a significant predictor of behavioral intention or actual behavior (D. Wang et al., 2022). Thus, even the core elements of TPB—attitudes, subjective norms, and perceived behavioral control—demonstrate varying abilities to predict doctors' behavioral intention to knowledge sharing and the actual behavior of knowledge sharing in different research contexts.

The intention of healthcare professionals to engage in shared decision making is influenced by multiple factors, and their relative importance varies depending on the type of healthcare professionals (Légaré et al., 2013). For example, midwives are more likely to provide information to patients and let them make decisions, while doctors are more likely to make decisions themselves (Dubé et al., 2013). The pressure on both patients and doctors may affect the intention of other healthcare providers (non-clinical doctors) to communicate with patients (Desroches et al., 2011). However, some studies have shown that the relationships between doctors' attitudes, subjective norms, perceived behavioral control, and behavioral intention in providing counseling services for epilepsy patients are similar to those between doctors and nurses (Lin et al., 2017). Given that doctors are the primary holders, disseminators, and applicators of knowledge, focusing on doctors with medical qualifications can avoid heterogeneity in research results. Furthermore, subjective norms are the most common influencing factor on behavioral intention, and the opinions of "significant others" come not only from colleagues and supervisors but also from patients (Thompson-Leduc et al., 2015). The patient population faced by doctors of different specialties varies, which may impact doctors' behavior differently (Widmer et al., 1998). Therefore, when studying knowledge sharing between doctors and patients, it is important to fully consider the healthcare context and professional background of the doctors.

In terms of the healthcare context, with the rapid development and progress of internet technology, online health communities have become an important platform for sharing public

concern and communication, whereas knowledge sharing between doctors and patients has received increasing attention (Meng et al., 2021; Zhang, Liu, Chen, et al., 2017). However, face-to-face interaction remains the primary channel for knowledge sharing (Olayemi & Olayemi, 2021). Therefore, the hospital consultation room is the primary setting for knowledge sharing between doctors and patients. Regarding professional background, chronic diseases are often characterized by long-term management, low reversibility, and difficulty of treatment. Chronic disease patients need to acquire sufficient medical knowledge for long-term health management (Gazmararian et al., 2003). However, these patients generally have insufficient health literacy. As a result, chronic disease doctors are more likely to perform knowledge sharing than doctors of other specialties. Additionally, TPB-based empirical studies on shared decision making, health education, and communication have been conducted among dietitians for dyslipidemia (Desroches et al., 2011), healthcare professionals (e.g., nutritionists, nurses, physiotherapists) for obesity (Ashby et al., 2012), and nurses for AIDS (Widmer et al., 1998). However, there are very few TPB-based empirical studies on knowledge sharing behavior of chronic disease doctors. Hence, this study, by focusing on face-to-face communication in the consultation room while considering doctors' professional background in chronic diseases, provides an ideal setting for accurately measuring knowledge sharing behavior.

2.3 Health literacy

2.3.1 Concept of health literacy

The concept of health literacy was first introduced by American scholar Simonds (1974). With further research on health literacy, the concept has been continuously extended and enriched. Nutbeam (1998) defined health literacy as individuals' ability to gain access to, understand, and effectively use health information to maintain and promote good health. In the same year, the World Health Organization (WHO) defined health literacy as a set of actions individuals take to improve personal and community health by using knowledge, skills, and confidence in ways that change lifestyles and living conditions (Nutbeam, 1998). In 1999, the American Medical Association (AMA) defined health literacy as the ability to read, comprehend, and perform numeral tasks required to function in the healthcare environment (Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, 1999).

Nutbeam (2000) extended WHO's definition of health literacy by incorporating the concept of individual health self-efficacy. He argued that health literacy should not only include

understanding the knowledge and the determinants of health, but also encompass changing attitudes and motivations related to health behaviors and improving self-efficacy in solving health-related problems. This perspective emphasizes individuals' awareness of their health status and self-management abilities. Additionally, Nutbeam (2000) proposed that health literacy involves three interrelated levels: functional literacy, interactive literacy, and critical literacy. Functional literacy refers to basic listening, speaking, reading, writing, and comprehension skills at the foundational level. Interactive literacy refers to the ability to understand and apply health information in social contexts, at a more advanced level. Critical literacy refers to the ability to critically analyze and evaluate health information, at the most advanced level. In 2001, the National Library of Medicine defined health literacy as the ability to obtain, process, and understand basic health information and services needed to make appropriate health decisions (Ratzan, 2001). This perspective highlights that individuals should have the ability to make informed decisions about their own health.

In 2012, the European Health Literacy Consortium summarized and classified the previous concepts of health literacy from both the personal and public health perspectives, dividing health literacy into three key domains—healthcare, disease prevention, and health promotion—which correspond to the stages of "being ill, being at risk, and staying health", respectively (Sørensen et al., 2012). It includes six main aspects: (1) competence, skills, and abilities; (2) actions; (3) information and resources; (4) objective; (5) context; and (6) time. The European Health Literacy Consortium's classification provides a comprehensive perspective that takes into account both individual knowledge and skills and the social environment and resources. In 2005, the term health literacy was first introduced and used in Chinese academia. At the crossroads of medical science and public health, health literacy was defined as the ability to gain access to, understand, assess, and use health information in the domains of healthcare, disease prevention, and health promotion (Sørensen et al., 2012). In a recent review article, the definition of health literacy was further extended to include three aspects: knowledge related to health, healthcare, and the health system; the ability to process and apply information related to health and healthcare; and the ability to maintain health through self-management and collaboration with healthcare providers (C. Liu et al., 2020).

In summary, health literacy involves an individual's knowledge, skills, attitudes, motivations, and self-efficacy, while also being influenced by the social environment and resources. A large number of studies have confirmed that health literacy is crucial for chronic disease patients in self-management, prevention, and control of their condition (Dunn & Conard, 2018; Marciano et al., 2019). In this study, considering the research object and goals, we define

patient health literacy as the ability of chronic disease patients to gain access to, understand, use, and assess basic health information and services and make informed decisions that can help to improve and maintain their health. Doctors are typically the most reliable source of medical information for patients (Poureslami et al., 2007) and are able to assess a patient health literacy. Therefore, chronic disease doctors' perception of patient health literacy is essential for the long-term maintenance of the doctor-patient relationship.

2.3.2 Dimensions of health literacy

The Institute of Medicine of the US identified cultural and conceptual knowledge, listening, speaking, arithmetical skills, writing skills, and reading skills as the main components of individuals' health literacy (Nielsen-Bohlman et al., 2004). In addition to the fundamental reading and numeracy skills, Speros (2005) also included comprehension, capacity to use health information in decision making, and successful functioning in healthcare consumer role as dimensions of health literacy. Baker (2006) divided health literacy into health-related print literacy (the ability to read and use printed materials) and health-related oral literacy (the ability to understand and express spoken messages). Paasche-Orlow and Wolf (2007) further divided health literacy into listening, verbal fluency, memory span, and navigation. These skills reflect the core abilities required for an individual to be a competent patient.

Nutbeam is a representative scholar in the field of health literacy. His framework for understanding health literacy has been widely cited and adopted by scholars worldwide. Nutbeam (2000) argued that health literacy includes three aspects: functional literacy (the basic level), interactive literacy (the more advanced level), and critical literacy (the most advanced level). Patients who have functional literacy are able to access and understand health-related information. Patients who exhibit interactive literacy are able to extract relevant information from communication with doctors and apply it to medical decision making and health behaviors. Patients who have critical literacy can critically analyze and evaluate the information provided by doctors and are capable of making informed health choices and medical decisions. These three levels of health literacy are not independent but interdependent and progressive. Urstad et al. (2022) noted that it is difficult to distinguish between the second and third levels according to Nutbeam's description of health literacy, and thus combined them for practical purposes. This hierarchical relationship reflects an individual's growth and progression in health literacy.

Building on Nutbeam's three-level description of health literacy, subsequent research and theoretical development have further expanded the theory in many directions. Mancuso (2008) suggested that health literacy encompasses three main attributes: capacity (collecting, analyzing,

and evaluating information), comprehension (effective interaction and interpretation of information), and communication (exchange of thoughts through speech and signals, among others). Sørensen et al. (2012) pointed out the limitations of previous research and, from both medical and public health perspectives, combined the four dimensions of health information processing (access, understand, appraise, and apply) with the three domains (healthcare, disease prevention, and health promotion), creating a matrix with 12 dimensions of health literacy. These three domains represent the expansion from an individual perspective to a group perspective. Frisch et al. (2012), drawing on the dimensions of media literacy, information literacy, science/scientific literacy, cultural literacy, and civic/political literacy, proposed that health literacy could include seven dimensions: functional literacy, factual and procedural knowledge, awareness, critical dimension, affective dimension, and attitudes. Thus, health literacy is not a singular knowledge and skill but a multi-dimensional and multi-level concept. These theoretical expansions not only have enriched the dimensions and connotation of health literacy but also have promoted cross-disciplinary integration and strengthened the practical application of health literacy. The multidimensional health literacy model enables the precise identification of health-literacy deficits across diverse populations, thereby furnishing empirical grounds for tailored health interventions and enhancing the efficacy of health-promotion initiatives. This advancement propels health-literacy research toward greater scientific rigor and practical utility, thereby contributing to the refinement of a comprehensive theoretical framework and furnishing policymakers with evidence-based references for decision-making.

Despite variations in the descriptions of health literacy dimensions, those dimensions can be categorized into two main groups: core elements (functional, interactive, and critical) and application domains (Sørensen et al., 2012). Chronic disease health management is an ongoing process that requires constant updating and accumulation of health knowledge. Patients not only need to acquire and understand basic knowledge about their chronic diseases, but also need to frequently communicate with doctors, assess treatment plans, and engage in treatment decision making. This progressive process mirrors the three levels of health literacy (functional, interactive, and critical) and is closely related to the four key steps of health information processing (access, understand, appraise, and apply). Furthermore, in chronic disease management, patients must pay close attention to the treatment process, take effective measures to actively control risk factors, and carefully monitor the environmental factors that may influence personal behaviors and lifestyles. This comprehensive, multi-layered health management strategy is well-reflected in the three domains: healthcare, disease prevention, and health promotion.

Research on health literacy is still in its early stages. In general, there is more research on outcomes of health literacy than its influencing factors. The factors influencing health literacy include social factors and personal factors. The impact of health literacy on individuals is reflected in their health behaviors, health status, and healthcare burden. Currently, most research findings are based on patients' subjective reports. However, compared to doctors, patients tend to overestimate their health literacy levels (Casta et al., 2024). Therefore, it is particularly important to evaluate patient health literacy levels through doctors' lenses.

2.3.3 Factors influencing health literacy

The formation and development of individuals' health literacy are influenced by various factors, with education level, occupation, and income being the key social factors. These factors not only directly affect an individual's opportunity and ability to acquire health knowledge but also shape the individual's health literacy level to varying degrees. Additionally, individuals' learning ability and age, as well as the use of digital communication tools, also play important roles.

Social group classification is mainly based on education level, occupation, and income. Among the various factors influencing health literacy, these three may be the most critical ones. Patients with higher education may consistently exhibit elevated levels of perceived patient health literacy, ostensibly attributable to systematic knowledge acquisition and rigorous critical-thinking training that confer superior capacities for comprehending health-related information. The close relationship between education level and health literacy has been consistently confirmed in numerous studies (Bettis et al., 2024; Sadeghian et al., 2023). While a higher education level does not necessarily mean higher health literacy (Svendsen et al., 2020), it provides a foundation for assessing, understanding, and applying health knowledge at the cognitive level.

High-income groups typically have more opportunities to receive high-quality education. A study by Fazli et al. (2023) found that socioeconomic factors were independently related to limited oral health literacy, with participants living in urban areas and having better financial conditions showing higher levels of oral health literacy. Similar studies in other countries also support the relationship between income and health literacy (Fazli et al., 2023). The first European Health Literacy Survey indicated that economic poverty was the strongest predictor of low health literacy, followed by social status, education, and age; comparatively, gender had less influence (Sørensen et al., 2015). Additionally, in the Chinese cultural context, the relationship between education level, personal income, and health literacy in chronic disease

patient populations has also been confirmed (Liu et al., 2023; Sun et al., 2022).

An individual's health literacy level is not only influenced by their formal education but is also largely dependent on the opportunities they have to gain access to and participate in health education, as well as their personal learning ability. The relationship between age and health literacy has often been studied, but the results are not consistent (Alqarni et al., 2023; Liu et al., 2023). Two studies in China showed that higher education and income were protective factors for health literacy across all age groups (Yang et al., 2021), while the impact of age on health literacy varied by gender (Sun et al., 2022). However, the latter study also showed that education and income were influencing factors of health literacy in both male and female patients (Sun et al., 2022). A study in South Korea showed that, in the age group of 20 to 44 years, having private medical insurance and higher self-reported health status were positively associated with health literacy, while in the age groups of 45 to 64 and 65 and above, education level was positively associated with health literacy (Lee et al., 2017). Therefore, the influence of age on health literacy may be affected by other factors.

The primary function of digital communication tools is to provide individuals with opportunities to receive health education (Naef et al., 2023; Yu et al., 2023). Mobile health applications embed functions such as interactive educational content, symptom tracking, medication reminders, and peer support communities (Laranjo et al., 2018). They can significantly improve patients' knowledge and confidence in using medical devices (Greenwell et al., 2021). Telemedicine platforms, by enabling real-time interaction with healthcare providers, can improve patient health literacy (Hollander & Carr, 2020). Websites, online forums, and social media platforms provide patients with a wide range of health information and support (Patil et al., 2021). ChatGPT can quickly and effectively answer patients' health-related questions (Hopkins et al., 2023). However, due to factors such as the varied quality of online information, the digital divide (Papadopoulos & Cleveland, 2023; Saeed & Masters, 2021), and the imperfect functionality of AI tools (Jazi et al., 2023), digital communication tools do not always enhance individuals' health literacy.

Besides, other factors that influence individuals' health literacy include vision (Münstermann et al., 2023), hearing (Piao et al., 2023; Wallace et al., 2022), language (Ugas et al., 2023), and memory and reasoning ability (Paasche-Orlow & Wolf, 2007). They all may limit individuals' ability to access and understand health information. For example, older adults (Shahid et al., 2022) and patients with mental disorders (Friis et al., 2016) are typical populations where cognitive deficits negatively impact health literacy. Therefore, while health literacy is closely related to education level (Manganello, 2008), it is also associated with

individuals' overall literacy (Zarcadoolas et al., 2003, 2005) and health status (Naseribooriabadi et al., 2017). In summary, social and personal factors jointly influence the formation and development of individuals' health literacy. Furthermore, medical knowledge is significantly related to health literacy (Barańska & Kłak, 2022; Gazmararian et al., 2003; Mancuso & Rincon, 2006). In chronic disease management, improving medical knowledge is an important way to enhance patients' overall health literacy. While factors such as education level, personal income, age, gender, vision, hearing, language ability, and cognitive ability may all influence an individual's health literacy, doctors, as the authority and primary source of medical knowledge (Poureslami et al., 2007), should adjust their communication strategies promptly to better accommodate patients with different health literacy levels, ensuring that all patients can clearly understand what they need to do (Lee et al., 2015; Liu et al., 2023).

2.3.4 Outcomes of health literacy

Numerous factors contribute to limited health literacy, which in turn, has direct and profound negative effects on an individual's physical and mental health, as well as posing challenges to societal well-being to varying degrees.

Health literacy may influence the public's healthy lifestyles and health behaviors. Through a study in Denmark, Svendsen et al. (2020) found a positive relationship between health literacy and health-related behaviors (e.g., smoking, alcohol consumption, physical activity levels, and weight). However, after controlling for socioeconomic factors, only physical activity levels and weight were related to health literacy. Aaby et al. (2017) revealed that "understanding health information" was negatively associated with physical inactivity, unhealthy diet, underweight, and obesity, while "interaction with healthcare providers" was negatively associated with physical inactivity, unhealthy diet, and daily smoking. Furthermore, lower health literacy can also result in lower adherence to medications and treatments (Forray et al., 2023; Morais et al., 2023). Compared to medication regimens, non-medication treatments (e.g., lifestyle changes, exercise, and diet) exhibit a higher average correlation between health literacy and adherence (Miller, 2016). Additionally, health literacy affects individuals' adoption of preventive health measures. Populations with limited health literacy are less likely to undergo cancer screening (Kim & Han, 2016; Oldach & Katz, 2014), vaccinations (Berkman et al., 2011; Fenta et al., 2023), and annual health check-ups (Lee et al., 2021).

Low health literacy is a major barrier to effective chronic disease management. Several studies have confirmed that low health literacy is associated with poor health outcomes in diabetes (e.g., poor blood glucose control and complications in microvascular and

macrovascular systems) (Berkman et al., 2011; Saeed et al., 2018; Tseng et al., 2017). Gomes et al. (2020) found that, compared to type 2 diabetes patients, type 1 diabetes patients with high health literacy showed more frequent blood glucose control. With respect to other areas of chronic diseases, for example, lower health literacy was associated with increased severity of chronic obstructive pulmonary disease and a decline in respiratory-specific health-related quality of life (Omachi et al., 2013). In terms of quality of life indicators, health literacy has been found to be positively associated with most respiratory-specific health-related quality of life indicators (i.e., cough frequency, chest tightness, limitations on home activities, confidence to leave home, sleep quality, and energy levels) (Stellefson et al., 2019). There were significant differences between patients with adequate and inadequate health literacy regarding daily life, shortness of breath, health status, and quality of life (Puente-Maestu et al., 2016). Additionally, insufficient health literacy is also associated with postoperative complications (Theiss et al., 2022) and increased mortality rates (Peterson et al., 2011; Sudore et al., 2006). Moreover, individuals' health literacy not only affects their physical health but may also influence their mental health. Previous studies have confirmed a relationship between low health literacy and depressive symptoms (Lincoln et al., 2006; Pappadis et al., 2024).

Insufficient health literacy may increase an individual's healthcare burden. Limited health literacy is related to increased emergency room visits (Griffey et al., 2014; L. Zhang et al., 2020), higher hospitalization risks (Baker et al., 2002), reduced use of preventive healthcare (Scott et al., 2002), decreased frequency of medical service usage (Cho et al., 2008), higher medical costs (Howard et al., 2005), and increased morbidity rates (Schillinger et al., 2002). Through a longitudinal study evaluating health literacy and asthma outcomes, Mancuso and Rincon (2006) found that lower health literacy was associated with poorer quality of life, poorer physical functioning, and more frequent emergency visits for asthma within two years. Moreover, parents' health literacy also affects their children's health status (Zaidman et al., 2023). A retrospective cohort study found that for parents with lower literacy and less knowledge about asthma, their children were more likely to suffer from moderate or severe persistent asthma, thus more likely to be reported absent at school and require emergency visits or hospitalization for treatment (DeWalt et al., 2007). Furthermore, low health literacy can lead to medication errors and adverse drug events (Feifer, 2003). Therefore, limited health literacy brings more economic burdens to both individuals and the healthcare system.

Compared to health behaviors, health status, and medical burdens, trust in doctors is more of a subjective feeling and attitude. The new definition of health literacy includes not only medical knowledge and the ability to process and apply that knowledge but also the ability to

maintain health through self-management and collaboration with healthcare providers (C. Liu et al., 2020). Studies have shown that the doctor-patient relationship can influence health behaviors (e.g., diet, foot care, physical exercise, and diabetes drug adherence) (Ciechanowski et al., 2004), patients' utilization of healthcare services (LaVeist et al., 2009; O'Malley et al., 2004; Sheppard et al., 2004), and disease outcomes (Schoenthaler et al., 2014). Generally, the higher the health literacy level, the greater the patient's trust in doctors and the healthcare system (Rodríguez et al., 2013; Tsai et al., 2018; White et al., 2013). Therefore, in terms of doctor-patient relationships, the influence of health literacy on health outcomes may be indirect, through the trust patients place in doctors. More specifically, when patients have higher health literacy, they are more likely to establish a trustful relationship with doctors, which leads to more active participation in treatment and self-management, thereby achieving better health outcomes.

In summary, the negative impacts of insufficient health literacy on an individual's health behaviors and health status, as well as societal burden, seem to be progressive. That is, insufficient health literacy can lead to poor lifestyles, which cause poor disease control outcomes, eventually resulting in increased healthcare burdens. In promoting the translation of health literacy into health behaviors, healthcare providers have the responsibility to share medical knowledge with patients using appropriate communication strategies and easy-to-understand language (Lee et al., 2021; Poureslami et al., 2022). Health literacy levels can indirectly affect health outcomes, with patients' trust in doctors being an important mediator. Therefore, in the setting of chronic disease diagnosis and treatment, through effective knowledge sharing by doctors, the improvement of patient health literacy may positively impact the doctor-patient relationship.

2.4 Doctor-patient trust

2.4.1 Concept of doctor-patient trust

The three elements of the doctor-patient relationship are the doctor, the patient, and the so-called third parties (society, government, and organizations) (Mead & Bower, 2000). The doctor-patient relationship, which was viewed as the relationship between the healer and the patient over 5,000 years ago, has now gradually evolved into a provider-user relationship (Harbishettar et al., 2019), a partnership (Veatch, 1972), and a supplier-consumer relationship (Reeder, 1972). For a long time, Chinese doctors have been used to playing a paternalistic role

(Fritzsche et al., 2012; Sun et al., 2020). The concept of the doctor-patient relationship can be defined in both a broad and narrow sense. In the broader sense, "doctor" includes not only physicians but also nurses, technicians, administrative managers, support staff, and the medical institutions they work at, while "patient" not only includes individual patients but also encompasses the patient's guardians, family members, and other related persons. The narrow definition of the doctor-patient relationship specifically refers to the interactive relationship between doctors and patients that arises during the medical process. This study selects doctors as the research subject to explore the narrow concept of the doctor-patient relationship, namely, the specific relationship between doctors and chronic disease patients in the hospital consultation room.

An ideal doctor-patient relationship can be summarized by six C's: choice, competence, communication, compassion, continuity, and conflict of interest (Emanuel & Dubler, 1995). According to Emanuel and Dubler (1995), trust is the ultimate embodiment of these six C's rather than an independent factor. However, Ridd et al. (2009) suggested that the doctor-patient relationship is composed of four components: knowledge, trust, loyalty, and respect. According to the case descriptions by Chipidza et al. (2015), these four components seem to follow a sequential progression order. Han et al. (2022) considered trust as an important component of a successful doctor-patient relationship. Mi et al. (2024) regarded trust as the main factor influencing the development of doctor-patient relationship. Regardless of the scholars' specific viewpoints, trust has been consistently regarded as the core element and an important manifestation of the quality of the doctor-patient relationship. Besides, "trust" may be a key link following "knowledge."

Doctor-patient trust involves both parties, including the trust patients place in doctors (perception of patients) and the trust doctors have in patients (perception of doctors) (Han et al., 2022). Patients' trust in doctors refers to patients' belief that doctors will act in patients' best interests and provide support and help in treatment and care (Anderson & Dedrick, 1990). Doctors' and patients' evaluations of the doctor-patient relationship and the reasons for these evaluations may differ (Y. Wang et al., 2022). In the development of a Chinese doctor-patient relationship scale from the doctor's perspective, Tao et al. (2021) stated that doctors' trust in patients includes not only positive aspects such as believing in the information patients provide, understanding patients' emotions when seeking medical consultation, and recognizing patients' treatment goals, but also negative aspects such as having a protective attitude toward patients and being concerned about potential threats to personal safety. Therefore, doctors' trust in patients can be understood as the belief that patients will honestly provide information,

understand and respect treatment recommendations, and actively cooperate with treatment plans, so as to promote doctor-patient cooperation and improve treatment outcomes.

2.4.2 Factors influencing doctor-patient trust

Doctor-patient trust is the result of multiple factors, including patient characteristics, medical factors, interpersonal factors, and societal factors. Given the paramount theoretical and practical significance of dissecting the interactive mechanisms among these factors for cultivating a harmonious and stable doctor-patient trust, examining the determinants of doctor-patient trust is of great significance.

In terms of personal characteristics, doctor-patient trust may be influenced by factors such as the doctor's age, gender, and specialty, or the patient's residence, education level, and medical insurance (Mao et al., 2021). However, these demographic characteristics are more often considered as control variables or moderators in existing studies. If we consider the factors influencing face-to-face interactions between doctors and patients as the innermost layer, the outer layers of factors influencing the doctor-patient relationship will include compensation systems (Xu & Yuan, 2022), work intensity (Qiao et al., 2019; Yang et al., 2023), negative media coverage (Qiao et al., 2019; Wang & Du, 2023), workplace violence (Tuominen et al., 2023), and medical disputes (Shen et al., 2023). Additionally, the factors on the outermost layer, such as policies, institutions, culture, technology, and insurance, may also create conflicting demands and challenges for doctors, making it increasingly difficult to balance their roles (Li & Khan, 2022; Yang et al., 2019). Although external environments and personal characteristics can both influence the doctor-patient relationship, this study, which adopts the concept of the doctor-patient relationship in a narrow sense, will focus on the direct factors influencing doctor-patient trust within the consultation room.

Doctor communication is a core element in establishing doctor-patient trust (Lunn & Sánchez, 2011; Rathert et al., 2013). Mauksch et al. (2008) suggested that efficient time management is key to improved communication. According to Drossman et al. (2021), effective communication skills can improve the doctor-patient relationship. A large amount of evidence has shown that many patient complaints are related to ineffective communication, which leads to misunderstandings and decreased satisfaction with the services provided (Kravitz, 2001; Ware et al., 1983). However, there may be differences in how doctors and patients evaluate the effect of communication on doctor-patient trust. Y. Wang et al. (2022) found that self-reported communication by doctors could not predict the doctor-patient relationship, whereas self-reported communication by patients significantly predicted the doctor-patient relationship,

suggesting that patients' evaluation of doctor communication is an effective predictor of the doctor-patient relationship.

One important reason for the different evaluations of doctor communication by doctors and patients is doctors' empathy (Grosseman et al., 2014). Communication skills are the core of a doctor's ability, whereas empathy is a vital component of doctor communication. Communication without empathy can hinder the doctor-patient relationship (Klitzman, 2006). Numerous studies have shown that empathy has a clear value in establishing the doctor-patient relationship and is related to the patient's clinical outcomes (Hojat et al., 2011; Schnur & Montgomery, 2010). A qualitative study found that empathy could help to maintain the doctor-patient relationship during conflicts (Gerace et al., 2018). Wu et al. (2022) revealed that patients' perception of doctors' empathy could directly influence their overall trust in doctors and indirectly affect their evaluation of the doctor-patient relationship through enhanced trust in doctors' kindness.

Understanding what patients want and what is important to them is often an overlooked matter in healthcare (Schattner et al., 2006). When patients have clear and reasonable expectations regarding the doctor's duties, abilities, and treatment processes, they are more likely to understand and trust the doctor. However, conversely, misunderstanding can lead to differences in expectations between patients and healthcare providers (Dang et al., 2017). When patients have unrealistic expectations during the healthcare process, it may lead to poor adherence (Lahri et al., 2022) and overestimation of treatment outcomes (Xiao et al., 2023). Patients' expectations that are incompatible with the doctor's medical style, approaches, and treatment plan can also affect the stability of the doctor-patient relationship (Lehman & Edirisinghe, 2023).

Patients' preferences for playing a role in shared decision making vary across cultures (Noteboom et al., 2021; Yılmaz et al., 2019). Different decision-control preferences may influence the development of doctor-patient trust. In a study in the US, Ruhnke et al. (2020) found that hospitalized patients who expected to delegate medical decisions to doctors were more satisfied with their doctors and exhibited higher trust in them. Kraetschmer et al. (2004) found that while a desire for a passive role was significantly associated with higher levels of trust, a desire for an active role was associated with lower levels of trust. However, those who preferred a shared decision-making role also demonstrated high (but not blind) trust levels. In contrast, a focus group interview with five female participants revealed that patients' active engagement in medical decision making might result in doctors' negative feelings toward the patients, thereby causing the doctor-patient relationship to deteriorate (Kawabata et al., 2009).

An increasing number of people are seeking and acquiring health-related information from the internet and sharing it with doctors during consultations. However, there are variations in how discussing online health-related information impacts the doctor-patient relationship (Luo et al., 2022). Audrain-Pontevia and Menvielle (2017) found that social support from online health communities can empower patients and make them more engaged in the medical process, thus enhancing their commitment to the doctor-patient relationship. On the other hand, Mota et al. (2018) reported that 85.2% of doctors believed that online health information had both positive and negative impacts on the doctor-patient relationship. A systematic review by Tan and Goonawardene (2017) showed that whether online health information search can improve the doctor-patient relationship depends on whether patients discuss the online health information with their doctors and the nature of their existing relationship. If doctors support patients in obtaining online health information, it would encourage the patient to actively engage in communication with the doctor, thus increasing the trust between them (Audrain-Pontevia & Menvielle, 2017).

In the context of increasing patient involvement in decision making, which leads to evolving doctor-patient relationships, health literacy is an important factor to consider (O'Dell, 2012). The patient's medical cognitive abilities and the accuracy of their self-reported health status will influence the doctor's trust in the patient (Luo et al., 2023). Ideally, patients with sufficient health knowledge seem to engage more actively in their medical processes (O'Dell, 2012). There seems to be a reciprocal positive relationship between health literacy and doctor-patient trust. A good doctor-patient relationship can better support patients in understanding and evaluating relevant health information (Peltzer et al., 2020; Siembida & Bellizzi, 2015). Specifically, higher perceived patients' health literacy enables patients to accurately comprehend medical directives, and thereby elevate doctor-patient trust; reciprocally, intensified trust motivates physicians to engage in more comprehensive knowledge sharing, further augmenting patients' health literacy and establishing a virtuous cycle.

In summary, chronic disease patients typically need long-term management and continuous health guidance (Liu et al., 2023). In this process, doctors and patients need to engage in long-term knowledge sharing. Therefore, establishing and maintaining a trust-based relationship is particularly important.

2.5 Job effort

The Effort-Reward Imbalance (ERI) model proposed by Siegrist (1996) is a theoretical

framework that explores the formation mechanism and principles of individuals' work stress from a social exchange perspective. The core components of the model include effort, reward, and the effort-reward ratio. Effort refers to the various resources that employees invest in their work, such as time, energy, knowledge, and skills. In the ERI model, effort is further divided into multiple dimensions, such as workload, job difficulty, and job complexity. Reward refers to the various forms of returns employees receive from their work, including economic rewards (e.g., salary and bonuses) and non-economic rewards (e.g., respect, promotion opportunities, and job security). The effort-reward ratio is used to quantify the balance between the effort employees invest and the rewards they receive in their work. The model suggests that employees expect a certain balance between their efforts and the rewards they receive. When there is an imbalance, where the effort (e.g., hard work, responsibility, and working hours) is disproportionate to the rewards (e.g., money, promotion opportunities, and work recognition), it can lead to stress, dissatisfaction, and even negative effects on physical and mental health (Siegrist & Li, 2016).

The ERI questionnaire consists of 23 items, divided into three sections: effort (six items), reward (11 items), and overcommitment (six items). The effort-reward imbalance is calculated as the ratio of the total effort score (E) to the total reward score (R), adjusted by C, represented as ERI = E / (R × C), where C is the ratio of the number of effort items to the number of reward items (Niedhammer et al., 2004). Those who score in the top third in the overcommitment dimension are considered to be overcommitted (Siegrist et al., 2004). Based on the 23-item ERI questionnaire, Siegrist et al. (2009) further developed a short version with 16 items, which includes three scales: effort (three items), reward (seven items, including two items on self-esteem, two on job security, and three on promotion), and overcommitment (six items). Li et al. (2012) tested the psychometric properties of the 16-item ERI questionnaire in a Chinese sample.

In recent years, many studies have begun to focus on the impact of effort-reward imbalance on individuals' health functions and psychological state. Previous studies have shown that effort-reward imbalance is associated with sleep disorders (Li et al., 2024), mental disorders (J. Zhang et al., 2021), hypertension (Boucher et al., 2017), and coronary heart disease risk (Dragano et al., 2017). In addition, heart rate variability, blood lipid changes, and metabolic syndrome risk may serve as mediators between the stress caused by effort-reward imbalance and stress-related diseases (Siegrist & Li, 2017). A review article indicated that higher effort-reward imbalance and overcommitment were associated with lower immunity (Eddy et al., 2016). The ERI model can be used to explain work stress in both blue-collar workers or groups engaged in manual labor and white-collar workers (Siegrist et al., 2004).

Doctors' effort-reward imbalance appears to be higher than that of non-medical personnel (Le Huu et al., 2022) and may also be higher than that of other healthcare workers (e.g., nurses, technicians, dentists, and other caregivers) (Le Huu et al., 2022). Li et al. (2006) found that effort-reward imbalance was related to impaired health in Chinese doctors. Through a survey in Liaoning Province, China, Liu et al. (2012) found that the effort-reward ratio and overcommitment were both significantly related to depressive symptoms in doctors. At the same time, effort-reward imbalance also negatively affects the quality of working life (Liang et al., 2023), leads to loss of productivity (Boren & Veksler, 2023), causes burnout (Leineweber et al., 2021), and increases turnover intention (Fei et al., 2023). Through a survey in Shanghai, Wang et al. (2014) validated the effectiveness of the ERI model in predicting burnout in Chinese doctors. He et al. (2017) studied Chinese oncologists and further revealed that higher effort-reward imbalance could predict greater emotional detachment, and overcommitment was independently related to emotional exhaustion. In summary, the ERI model seems to have strong explanatory power for work stress in Chinese doctor samples (Li et al., 2006). In the work environment, Chinese doctors may face high work intensity and high responsibility and pressure, while receiving lower work rewards, including material rewards and social recognition.

As research advanced, Siegrist and Li (2016) found that effort, reward, and overcommitment could independently predict an individual's work stress. Knowledge sharing between doctors and patients is just one of the many "efforts" that doctors make in complex clinical settings. Doctors' work goes beyond conveying medical knowledge; it also includes diagnosing conditions, developing treatment plans, performing medical procedures, monitoring disease progression, and providing emotional support through communication with patients and their families. In a high-intensity work environment, doctors may be unable to effectively implement knowledge-sharing plans due to energy depletion and emotional fatigue, even if they initially intend to do so. In the current Chinese healthcare system, doctors' compensation is often directly linked to measurable indicators such as the amount of work done, work difficulty, and work complexity. However, for soft services like knowledge sharing, there is a lack of clear reward incentives. The lack of incentive mechanisms may lead doctors to neglect or reduce knowledge sharing with patients during their busy clinical work. Therefore, by focusing on the job effort of doctors during the consultation process and quantifying their time, energy, emotions, and other resources, we can have a more accurate understanding of how these efforts influence doctors' knowledge sharing behavior.

In summary, job effort is an essential component of the ERI model. The model provides

good explanatory power for work stress in both medical and non-medical personnel. Moreover, job effort may independently predict doctors' work stress.

2.6 Research hypotheses

2.6.1 Doctors' attitudes toward knowledge sharing and behavioral intention

Attitudes significantly predict behavioral intention (Gold et al., 2024; Grace & Efua, 2023). Attitudes can be classified into accessible attitudes and stable attitudes, which guide behavior through two processes: memory retrieval and online reconstruction (Glasman & Albarracín, 2006). Compared to subjective norms and perceived behavioral control, the correlation between attitudes and behavioral intention may be stronger (Albarracín et al., 2001; Scalco et al., 2017). Attitudes not only may indirectly influence behavior through their effect on intention but can also directly influence behavior (Albarracín et al., 2001). Doctors are not only providers of medical services but also transmitters of health-related knowledge and information. A doctor's attitudes can significantly affect the process and outcomes of knowledge sharing.

In the medical field, the attitudes toward knowledge sharing among healthcare professionals is positively associated with behavioral intention (Bhatti et al., 2014; Ryu et al., 2003). In some studies, attitudes were found to be the most influential factor affecting the behavioral intention to knowledge sharing (Bhatti et al., 2014). In another study, attitudes were found to be the second most important factor influencing the behavioral intention to knowledge sharing, following subjective norms (Bhatti et al., 2014). Although some studies have extended the TPB model for healthcare professionals' knowledge sharing, attitudes have consistently been included as a key variable and have been found to have a positive relationship with behavioral intention (Li & Lowe, 2016; Opesade & Alade, 2020; Samad, 2018). Other studies have incorporated factors such as promotion and personal values as attitudes toward specific behaviors in the TPB model (Balozi et al., 2016). Some studies explored antecedents of the attitudes toward knowledge sharing, such as knowledge self-efficacy and enjoyment in helping others (Singh et al., 2018). As mentioned earlier, there is relatively less research applying TPB to knowledge sharing between doctors and patients. However, shared decision making (Légaré et al., 2013; D. Wang et al., 2022), health education (Walker et al., 2023), and communication (De Munnik, Vervoort, et al., 2017; Kiestra et al., 2020; Van Rijssen et al., 2011), which are related to knowledge sharing, have shown to be positively associated with attitudes. The doctor-patient relationship mode in China is typically paternalistic, with patients playing a passive role

(Li et al., 2014). In doctor-patient interactions, the doctor's attitudes toward knowledge sharing may determine the strength of the behavioral intention to knowledge sharing. Therefore, this study proposes the following hypothesis:

Hypothesis 1a (H1a): *Doctors' attitudes toward knowledge sharing (ATT) are positively associated with their behavioral intention to knowledge sharing (BI)*.

2.6.2 Doctors' subjective norms for knowledge sharing and behavioral intention

Normative beliefs include injunctive norms and descriptive norms (Cialdini & Trost, 1998; Fishbein & Ajzen, 2009). Injunctive norms refer to the perceived expectations or subjective probability of approval or disapproval of a specific behavior by a relevant individual or group (e.g., friends, family, spouse, colleagues, doctors, or superiors); descriptive norms refer to beliefs about whether significant others actually perform the behavior themselves (Ajzen, 2020). However, descriptive norms are not necessarily related to injunctive norms. A meta-analysis showed that subjective norms are often found to be weak predictors of behavioral intention (Armitage & Conner, 2001). The effect of subjective norms on actual behavior depends on the specific context. In the hospital consultation room, subjective norms play a significant role in influencing doctors' knowledge sharing.

In the medical field, some studies have found that subjective norms have the strongest effect on doctors' behavioral intention to knowledge sharing (Ryu et al., 2003). However, in some studies, subjective norms have been found to show little impact (Septiani et al., 2020). This inconsistency may be due to the one-sided nature of the subjective norms experienced by healthcare professionals. The subjective norms influencing knowledge sharing between doctors primarily come from social pressures from management, colleagues, key opinion leaders (KOLs), and professional associations (Radaelli et al., 2015). In the domains of shared decision making, health education, and communication between doctors and patients, some studies have found that subjective norms have a weak effect on behavioral intention (Sharifirad et al., 2015; Vaillancourt et al., 2015). However, other studies have suggested that subjective norms are an important predictor of behavioral intention (Deschênes et al., 2013; Légaré et al., 2013; D. Wang et al., 2022). Some studies have replaced general subjective norms with descriptive norms, moral norms, and normative beliefs, and confirmed their relationship with behavioral intention (Delanoë et al., 2016). Patients have the right to be informed about the cause of their illness, treatment plans, testing purposes, medication usage, and the potential progression of their condition. Compared to the subjective norms related to peers, the subjective norms arising from patients' expectations may be more impactful. In one study, only the perceived norms related

to patients' expectation for doctors to discuss lifestyle were significantly related to lifestyle counseling, whereas perceived personal norms (considering counseling as one of the doctor's duties) and descriptive norms (other doctors discussing lifestyle) did not have a significant relationship with providing counseling (Kiestra et al., 2020). Another study found that doctors' perceptions of patients' expectations were one of the major barriers to shared decision making (D. Wang et al., 2022). In China, patient expectations, colleagues' behaviors, and management systems can all affect doctors' intention to share knowledge with patients. Therefore, this study proposes the following hypothesis:

Hypothesis 1b (H1b): *Doctors' subjective norms for knowledge sharing (SN) are positively associated with their behavioral intention to knowledge sharing (BI)*.

2.6.3 Doctors' perceived behavioral control for knowledge sharing and behavioral intention

Perceived behavioral control consists of two dimensions: perceived ability, which refers to the perceived ease or difficulty of performing a behavior; and perceived autonomy, which refers to the perceived control over the behavior (Fishbein & Ajzen, 2009). Control factors include the necessary skills and abilities, the availability or lack of resources (e.g., time and money), and cooperation with others, among others (Ajzen & Schmidt, 2020). The control factors that affect knowledge sharing between doctors and patients mainly include time resources and communication skills.

In the medical field, perceived behavioral control significantly affects healthcare professionals' behavioral intention to knowledge sharing (Ryu et al., 2003). In doctor-patient interactions, perceived behavioral control significantly impacts the intention to shared decision making (Deschênes et al., 2013), intention to health education (Sharifirad et al., 2015), and intention to communication (Lin et al., 2017). A study on shared decision making revealed that perceived behavioral control was even the only predictor of behavioral intention (Vaillancourt et al., 2015). A meta-analysis also supports the positive effect of perceived behavioral control on both behavioral intention and actual behavior (Afshar Jalili & Ghaleh, 2021). We hypothesize that if doctors believe they can effectively control knowledge sharing behavior, for instance, by articulating medical knowledge clearly and accurately, and they have sufficient communication time or the ability to help patients understand and accept the information within a limited time, they are more likely to develop behavioral intention to knowledge sharing. Therefore, we propose the following hypothesis:

Hypothesis 1c (H1c): *Doctors' perceived behavioral control for knowledge sharing (PBC)*

is positively associated with their behavioral intention to knowledge sharing (BI).

2.6.4 Doctors' perceived behavioral control for knowledge sharing and actual behavior

Perceived behavioral control jointly determines behavioral intention with attitudes and subjective norms, and also directly affects the actual behavior (Chennamaneni et al., 2012). Doctors do not naturally possess excellent communication skills; rather, they need to continuously learn and acquire them through practice (Lee et al., 2002). Additionally, doctors must balance the time they invest in each patient with the need to carry out treatments according to plan. In order to maintain this balance, doctors may reduce the time spent on consultations (Beckman & Frankel, 1984). When external limitations exist, such as a lack of resources or necessary opportunities, intention alone is insufficient to form behavior (Armitage & Conner, 2001).

Chennamaneni et al. (2012) showed that perceived behavioral control and behavioral intention to knowledge sharing jointly explained approximately 41% of the variance in knowledge sharing behavior. Mafabi et al. (2017) also suggested that there is a stronger relationship between perceived behavioral control and knowledge sharing behavior. In a study on healthcare professionals providing consultation services, perceived behavioral control, both in the TPB model and in the extended TPB model that included perceived barriers, could effectively predict individuals' behavior (Lin et al., 2017). In China, doctors need to receive a large number of patients daily, forcing them to shorten the time spent on each patient (Sun & Rau, 2017). Similarly, a study in China showed that better communication skills could lead to better medical services (Guo & Wang, 2021). Many doctors are often inclined to overestimate their communication abilities (Ha & Longnecker, 2010). These factors may all constrain their knowledge sharing behavior. In other words, doctors' perceived control for knowledge sharing may directly influence their actual behavior. Therefore, this study proposes the following hypothesis:

Hypothesis 2a (H2a): *Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with the actual behavior of knowledge sharing (AB)*.

2.6.5 Doctors' behavioral intention to knowledge sharing and actual behavior

The core concept of TPB is behavioral intention, which is influenced by attitudes, subjective norms, and perceived behavioral control. Intention includes the degree of commitment to the target goals or behavior (Sheeran & Webb, 2016). Generally, the stronger the intention to

engage in a specific behavior, the more likely the behavior is to be enacted. However, strong intentions do not always lead to actual behavior (Sheeran & Webb, 2016). Intention can only explain part of the variation in behavior (Asare, 2015; McEachan et al., 2011). The disconnect between intention and behavior is referred to as the intention-behavior gap (Sheeran, 2002). Ajzen (2002b) posits that the reasons individuals fail to act on their newly formed intentions might include unforeseen harmful consequences, negative effects from important referents, underestimating the difficulty of implementing the behavior, and a lack of determination or willpower. Therefore, individuals' behavioral intention does not always predict actual behavior, and a change in intention does not always result in a change in actual behavior. Factors that affect the relationship between intention and actual behavior include restriction of range, lack of compatibility, forgetting, change of mind, low control over the behavior, and hypothetical bias. Thus, the stability of intention is the best indicator of the likelihood of the intention leading to actual behavior (Conner et al., 2002).

In research on knowledge sharing in the medical field, most studies have only included behavioral intention when using the TPB model (Bhatti et al., 2014). Typically, the intention is considered to partially mediate the relationship between perceived behavioral control and actual behavior (Kuo & Young, 2008; Pham Thi & Duong, 2022). However, not all studies support this partial mediation effect of behavioral intention. Mafabi et al. (2017), in their study on knowledge sharing among doctors and nurses, found that behavioral intention fully mediated the relationship between attitudes, subjective norms, perceived behavioral control, and actual behavior. In summary, the role of behavioral intention in predicting actual behavior is established. However, many TPB-based studies on shared decision making, health education, and communication between doctors and patients only examined behavioral intention without further measuring the relationship between intention and actual behavior (Kristina et al., 2019; Légaré et al., 2011; Vaillancourt et al., 2015). Ajzen (2020) suggested that it may be reasonable to use intention as a proxy for behavior when there is strong evidence of intention-behavior correlation in the population, environment, and timeframe under study. The treatment and management of chronic diseases often require prolonged periods, and the condition may relapse or progressively worsen. The relationship between doctors and chronic disease patients is typically long-term, which provides more stability for doctors to perform the knowledge sharing behavior. Therefore, this study proposes the following hypothesis:

Hypothesis 2b (H2b): *Doctors' behavioral intention to knowledge sharing (BI) is positively associated with the actual behavior of knowledge sharing (AB).*

2.6.6 Mediation of doctors' behavioral intention to knowledge sharing between perceived behavioral control and actual behavior

Building upon TRA, the TPB model further added the variable of perceived behavioral control. For behaviors that are fully volitional, the two theoretical models show almost no difference in their performance (Ajzen, 1985). However, when used to explain non-fully volitional behaviors, TPB may perform better than TRA (Millstein, 1996). Measurement of intention does not necessarily predict actual behavior, and changes in intention do not always lead to changes in actual behavior (Ajzen, 2020). In the TPB framework, perceived behavioral control does not directly influence actual behavior through behavioral intention, but rather, it works alongside behavioral intention as an antecedent to actual behavior.

Control factors include the necessary skills and abilities, the availability or lack of resources (e.g., time and money), and cooperation with others, among others (Ajzen, 2020). In the context of doctors sharing knowledge, perceived behavioral control reflects doctors' assessments of their ability, resources, and opportunities to successfully share knowledge. When doctors believe they have sufficient ability, resources, and opportunities to share knowledge, they are more likely to engage in knowledge sharing. However, time pressure and resource constraints are major challenges faced by doctors in China (Hu et al., 2016; S. Zhang et al., 2020). Doctors must balance the time spent on examination, diagnosis, and treatment with knowledge sharing. To achieve this balance, doctors may be forced to interrupt patients and reduce the time for open-ended questioning. In a study by Beckman and Frankel (1984), doctors interrupted conversations an average of 18 seconds after a patient started speaking. In a study on healthcare professionals providing sexual health counseling, the TPB framework, with or without perceived barriers incorporated, showed that behavioral intention mediated the relationship between perceived behavioral control and actual behavior (Lin et al., 2017). In a study on doctors educating adolescent patients about sexually transmitted infections and HIV, after adding perceived behavioral control to the TRA framework to create the TPB framework, the variance of behavioral intention and subsequent behavior was significantly increased (Millstein, 1996). Even if individuals believe they have the ability to share knowledge, without forming clear behavioral intention, that ability may not immediately translate into actual behavior. Therefore, the study proposes the following hypothesis:

Hypothesis 2c (H2c): *Doctors' behavioral intention to knowledge sharing (BI) mediates the relationship between perceived behavioral control for knowledge sharing (PBC) and actual behavior of knowledge sharing (AB).*

2.6.7 Doctors' knowledge sharing behavior and perceived patient health literacy

Knowledge sharing includes the dissemination and absorption processes, where the knowledge provider externalizes knowledge, and the knowledge recipient internalizes it (Ho et al., 2011). Knowledge sharing implies that the provider retains the ownership of the knowledge while enabling both the provider and the receiver to jointly possess the knowledge (Ipe, 2003). However, there exists a significant information asymmetry between doctors and patients, making it challenging to motivate doctors to share knowledge. Possessing knowledge often means holding power, and knowledge sharing can lead to shifts in power (Gider et al., 2015). With the emergence of patient-centered models, doctors' education of patients has shifted from simply transferring knowledge to co-creating knowledge (Aujoulat et al., 2008). Effective knowledge sharing leads to improved knowledge reserves, benefiting both doctors and patients.

In the field of chronic diseases, health literacy is independently related to disease knowledge (Gazmararian et al., 2003; Williams et al., 1998). Each patient's health literacy and cognitive ability are unique. Doctors should avoid assuming a patient's health literacy based solely on their education level (Lee et al., 2015). Furthermore, a high overall health literacy level does not necessarily indicate a high level of disease-related knowledge. Prior to diagnosis and treatment, the clinical value of assessing a patient's overall health literacy may be limited (Lee et al., 2015). In clinical practice, doctors typically need to adjust their communication methods to adapt to patients with varying health literacy levels, ensuring that patients understand the knowledge related to their conditions. This perspective aligns with suggestions by Chinese scholars Liu et al. (2023). Using patient health literacy as a dependent variable for doctors' knowledge sharing may have more practical implications. Patients are the first-line observers and experiencers of their own conditions. It is the patients who communicate to doctors the characteristics, frequency, duration, and dynamic changes of their symptoms. Therefore, helping patients better master and apply health knowledge is an indispensable way to improve their health literacy related to their diseases (Hironaka & Michael, 2008). Hence, the study proposes the following hypothesis:

Hypothesis 3a (H3a): *Doctors' actual behavior of knowledge sharing (AB) is positively associated with perceived patient health literacy (PPHL)*.

2.6.8 Doctors' knowledge sharing behavior and doctor-patient trust

The main goals of doctor-patient communication include not only sharing medical information (Georgopoulou et al., 2018), but also establishing a good doctor-patient relationship and

promoting patient engagement in decision making (Arora, 2003; Lee et al., 2002; Roter, 1983). Communication is the foundation for shared decision making and patient engagement (Chambers, 2017). The shared decision making model mainly involves information exchange, deliberation, and decision on the treatment to implement (Charles et al., 1997). Most health education programs are school- or organization-based and use standardized curricula (Rizvi, 2022). Health education is a one-way process where doctors impart medical knowledge to patients. However, knowledge sharing is not just a process of knowledge transfer; it also involves interaction between the knowledge provider and the knowledge recipient (Yao et al., 2021). Therefore, doctors' knowledge sharing can be seen as the exchange of medical knowledge, involving the "shared medical information" of communication and "information exchange" of shared decision making. Although research on the relationship between doctors' knowledge sharing and doctor-patient trust is relatively limited, knowledge sharing has some similarities with shared decision making, health education, and communication in terms of knowledge interaction. Therefore, the positive effects of shared decision making, health education, and communication on doctor-patient trust provide important insights for understanding the positive impact of knowledge sharing on doctor-patient trust.

Information asymmetry between doctors and patients is commonly found in the clinical healthcare environment across countries. In a study conducted in China, the information asymmetry between patients and doctors was identified as the most crucial reason for patients' distrust in doctors (Zhao et al., 2016). When patients have insufficient health knowledge, doctors and patients may not reach an agreement (Ankuda, 2012). In other words, doctors' trust in patients primarily stems from resource exchange and information communication (Luo et al., 2023). Information sharing and interaction can promote continuous communication and improved healthcare services. Doctors' knowledge sharing behavior reflects their support for patient autonomy and a patient-centered approach. When doctors are willing to share knowledge and address patients' concerns, patients will perceive doctors' care and professionalism, which can increase their trust in the doctor. While patient trust and doctor-patient trust are both important, if doctors trust patients, patients are also more likely to perceive the doctor's trust (Luo et al., 2023). Evaluating the level of trust patients have in doctors from the doctors' perspective may have more practical significance in hospital management. Therefore, this study proposes the following hypothesis:

Hypothesis 3b (H3b): *Doctors' actual behavior of knowledge sharing (AB) is positively associated with doctor-patient trust (DPT)*.

2.6.9 Perceived patient health literacy and doctor-patient trust

Low health literacy is a common problem worldwide (Nutbeam, 2008; Qi et al., 2021). When medical terminology frequently appears in medical conversations, patients often find it difficult to understand (Schillinger et al., 2004). Health literacy, as the sixth vital sign, is equally important as body temperature, pulse, respiration, blood pressure, and pain levels (Heinrich, 2012). An increasing number of Chinese scholars have focused on the health literacy of chronic disease patients in China (Wang et al., 2017; Zhao et al., 2021).

Compared to patients with higher health literacy, those with lower health literacy may struggle to understand medical information and follow disease management instructions (J. Zhang et al., 2020). At the same time, individuals with higher health literacy are more capable of engaging in doctor-patient interactions and medical decision making (Edwards et al., 2012; Longtin et al., 2010). In addition, improving health literacy can lead to better self-management, improved health outcomes (e.g., fewer hospitalizations), and greater health management abilities (Edwards et al., 2012). Therefore, from the doctor's perspective, a patient who is able to actively engage in their care and achieve effective self-management is more likely to trust the doctor and be willing to follow medical advice. Moreover, improving patient health literacy not only brings personal benefits but also has broader societal advantages. Higher health literacy can help create health-friendly environments, implement effective health policies, promote health initiatives, improve self-care abilities, enhance healthcare outcomes, and reduce medical costs (Nguyen et al., 2020). The overall improvement in health literacy reflects the patient's strong concern for and positive attitudes toward their health, while fostering a positive doctor-patient interaction atmosphere. Therefore, this study proposes the following hypothesis:

Hypothesis 3c (H3c): *Perceived patient health literacy (PPHL) is positively associated with doctor-patient trust (DPT)*.

2.6.10 Mediation of perceived patient health literacy between doctors' actual behavior of knowledge sharing and doctor-patient trust

Information asymmetry between doctors and patients occurs in clinical healthcare environments worldwide (Zhao et al., 2016). This information asymmetry is often the most significant factor leading to the tension between doctors and patients. Healthcare professionals have a unique advantage in helping patients access, understand, assess, and apply health information (Benjamin, 2012; Scheier, 2009; Wood et al., 2023). Patients who perceive they have received sufficient information and those who believe their doctor has explained their

condition in detail tend to have higher trust in their doctors (Keating et al., 2004). Therefore, by sharing knowledge about the causes of disease, treatment plans, examination purposes, and long-term outcomes, doctors can help patients gain a comprehensive understanding of their condition. This knowledge sharing not only reduces the fear of the unknown and uncertainty but also enhances patients' trust and cooperation in the medical process.

However, when medical terminology and jargon are frequently used in medical conversations, patients may face difficulties in understanding (Schillinger et al., 2004). If doctors overuse medical terms that are unfamiliar to patients and overestimate patients' comprehension ability, this can increase the risk of misunderstandings (Kelly & Haidet, 2007). Besides, difficulty in understanding and using health information may harm patients and increase healthcare costs (Cesar et al., 2022). Conversely, improving health literacy can bring various benefits, such as more active medical engagement, better self-management, and improved health outcomes (Edwards et al., 2012). Additionally, doctors' knowledge sharing behavior can demonstrate their expertise to patients (Ma et al., 2022). Therefore, doctors' knowledge sharing behavior not only can help patients understand the information, reduce misunderstandings, and promote health but also makes patients perceive the doctor's professionalism and sense of responsibility, thus enhancing their trust in the doctor's medical advice and treatment plans.

Health literacy is a fundamental element in empowering patients, enhancing their engagement, and activating them (Pelletier & Stichler, 2013, 2014). Patients with higher health literacy are more likely to actively engage in shared medical decision making (Pel-Littel et al., 2024) and better apply the knowledge and skills they have acquired to maintain their health (Piko & Keresztes, 2006). Patients' active engagement can also increase doctors' attention to the patient's condition and their sense of responsibility, making doctors feel closer and more confident (He et al., 2022). Moreover, better doctor-patient relationships are associated with higher patient adherence to treatment and follow-ups (Beach et al., 2006). Therefore, when doctors observe that patients continue to improve their health status through active self-management, they will perceive that the patients have more trust in them and show higher adherence to their instructions. Thus, doctors' knowledge sharing behavior may indirectly enhance doctor-patient trust by improving patient health literacy. Therefore, this study proposes the following hypothesis:

Hypothesis 3d (H3d): *Perceived patient health literacy (PPHL) mediates the relationship between doctors' actual behavior of knowledge sharing (AB) and doctor-patient trust (DPT)*.

2.6.11 Sequential mediation of doctors' behavioral intention to knowledge sharing, actual behavior of knowledge sharing, and perceived patient health literacy

According to TPB, individuals' attitudes, subjective norms, and perceived behavioral control jointly influence their behavioral intention, which in turn affects the occurrence of actual behavior (Ajzen, 1985, 1991). Behavioral intention is an important factor in predicting an individual's future actions. Once individuals form clear behavioral intentions, it means they have taken a crucial step toward changing or implementing new behaviors (Sheeran & Webb, 2016). However, the mere presence of behavioral intention does not guarantee the occurrence of actual behavior. Actual behavior is the final step in realizing behavioral intention. Therefore, the sequence from attitudes, subjective norms, and perceived behavioral control to behavioral intention and actual behavior constitutes a continuous and interconnected sequential effect.

Doctors' active sharing of medical knowledge is critical to raising patients' health awareness and improving their health literacy levels (Goto et al., 2020). Individuals with health awareness tend to better understand their health status and be more concerned with personal health issues, leading to the adoption of corresponding measures to maintain their health (Piko & Keresztes, 2006). In this process of knowledge sharing, patient health literacy becomes a crucial bridge connecting both doctors and patients. When doctors realize that patients possess high health literacy, particularly when this literacy is enhanced through the doctors' knowledge sharing, they are more likely to regard patients as partners actively engaged in the treatment process.

More importantly, doctors' knowledge sharing behavior can also stimulate patients' attention to health issues and engagement. Patients' active engagement in the medical process not only enhances doctors' sense of responsibility and professional confidence but also deepens the emotional connection between doctors and patients (He et al., 2022). Involving patients in decision making can improve patients' satisfaction, treatment adherence, physical function, and self-management ability (McGilton et al., 2018). These positive changes, as recognition of doctors' professional competence, can further strengthen the foundation of trust between doctors and patients.

In summary, perceived patient health literacy and doctor-patient trust, as two additional factors in the TPB framework, reflect the direct effects and long-term outcomes of doctors' knowledge sharing behavior. Therefore, this study hypothesizes that doctors' knowledge sharing behavior not only helps patients better understand and manage their health issues but also enhances cooperation between doctors and patients, laying a solid foundation for building

a harmonious doctor-patient relationship. Hence, the study proposes the following hypotheses:

Hypothesis 4a (H4a): *Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between attitudes toward knowledge sharing (ATT) and doctor-patient trust (DPT)*.

Hypothesis 4b (H4b): *Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between subjective norms for knowledge sharing (SN) and doctor-patient trust (DPT)*.

Hypothesis 4c (H4c): *Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between perceived behavioral control for knowledge sharing (PBC) and doctor-patient trust (DPT)*.

2.6.12 Moderation of job effort on the relationship between doctors' behavioral intention to knowledge sharing and actual behavior

An individual's behavioral intention does not always translate into actual behavior (Rhodes & Dickau, 2012; Sheeran & Webb, 2016). The nature of the goal, the foundation of the intention, and the characteristics of the intention all influence the rate at which intentions are converted into behavior (Conner & Norman, 2022). In recent years, China's large population and growing health awareness have led doctors to face the problem of overload in receiving patients. In medical practice, the amount of information exchanged between doctors and patients is often limited by time and economic resources, which may lead to fairness and cost problems. For example, the more time a doctor spends with a specific patient, the less time they will have to provide care to other patients who need services (Charles et al., 1999). Time constraints affect the doctor's ability to effectively share knowledge (Jabr, 2007). Therefore, even if doctors have the intention to share knowledge thoroughly, such as explaining the condition in detail and providing health guidance, the urgency of time may limit their ability to translate these intentions into actual behavior during their busy practice.

Chinese doctors need to handle a large clinical workload. Even during non-working hours, Chinese doctors must handle substantial learning tasks and work stress (Tian et al., 2020). In many studies conducted in China, dissatisfaction with income and high workload are often two coexisting factors in doctors' evaluations of poor doctor-patient relationships (Wu et al., 2014; Yang et al., 2023). Furthermore, the stability of intention, such as high goal commitment, is an

important moderator in the intention-behavior relationship (Conner & Norman, 2022; Zhou et al., 2017). However, under the current Chinese compensation system, knowledge sharing may not be a stable goal commitment for Chinese doctors. The longer the working hours of doctors, the less time they have for communication with patients (Wu et al., 2013). Therefore, even when Chinese doctors have a strong intention to share knowledge, they are often unable to fully implement knowledge sharing due to excessive work stress and mismatched compensation.

Studies have shown that clinical doctors and patients frequently encounter interruptions during consultations, with a median of four interruptions per consultation, which can significantly impact the quality of the consultation (Motsohi et al., 2024). Frequent interruptions may indicate that doctors are trying to balance the needs of multiple patients, handle urgent situations, or switch between multiple tasks. The frequent occurrence of interruptions disrupts the continuity of communication between doctors and patients, reducing the coherence and depth of knowledge transfer. As the difficulty of the goal increases, the ability of intention to predict behavior decreases (Sheeran et al., 2003). Doctors may find it difficult to focus on thoroughly explaining complex medical knowledge, and patients may struggle to concentrate on understanding and memorizing this information. Therefore, frequent interruptions may hinder the conversion of knowledge sharing intention into actual behavior and may even affect the actual implementation of knowledge sharing.

Thus, when doctors' job effort is at a higher level, even if they have high behavioral intention to knowledge sharing, it is difficult for them to implement knowledge sharing. Thus, this study proposes the following hypothesis:

Hypothesis 5a (H5a): *Job effort (JE) weakens the relationship between doctors' behavioral intention to knowledge sharing (BI) and actual behavior of knowledge sharing (AB)*.

2.6.13 Moderation of job effort in the relationship between doctors' actual behavior of knowledge sharing and perceived patient health literacy

TPB mainly focuses on predicting individuals' action choices but does not fully consider the influence of macro-level factors on behavior selection. With the continuous development of healthcare systems and the increasing diversification of patients' health needs, doctors are forced to take on multiple roles, including but not limited to service providers, disease evaluators, medical researchers, and resource allocators (Rachagan & Sharon, 2003). However, policies, institutions, culture, technology, and insurance put doctors under constant challenges from conflicting demands, making it increasingly difficult for them to balance these roles (Magnezi et al., 2015; Rachagan & Sharon, 2003; Yang et al., 2019). Under the condition of

limited time and resources, this challenge of balancing roles forces doctors to prioritize more urgent and direct tasks, such as emergency diagnosis and treatment. In this situation, even if doctors engage in frequent knowledge sharing, they may not be able to fully or comprehensively notice the changes in patient health literacy.

China is facing a shortage of high-quality doctors and an imbalance between the supply and demand for healthcare services. Long-term exposure to high workload can lead to fatigue and burnout among Chinese doctors (Wu et al., 2013). When doctors rush to speed up patient visits, they often quickly interrupt the patient's opening statement and may even interrupt patients two or more times during consultations (Marvel et al., 1999; Rhoades et al., 2001). Therefore, in a fast-paced work environment, doctors are forced to accelerate the clinical decision making process and thus may lack the energy and patience to thoroughly understand and assess patient health literacy.

Doctors often encounter various interruptions during consultations (Motsohi et al., 2024). These sudden interruptions or disturbances may distract doctors' attention, weakening their focus during the knowledge sharing process, which in turn affects their accurate judgment and evaluation of patient health literacy level. For example, they may fail to fully understand patients' questions and confusions and may not be able to assess whether patients have fully understood the information they conveyed.

Therefore, when job effort is at a higher level, the positive impact of doctors' actual behavior of knowledge sharing on perceived patient health literacy may be weakened. Hence, this study proposes the following hypothesis:

Hypothesis 5b (H5b): *Job effort (JE) weakens the relationship between doctors' actual behavior of knowledge sharing (AB) and perceived patient health literacy (PPHL)*.

2.7 Research model

Based on TPB, we constructed a hypothesized model to illustrate the influencing factors and

outcomes of the knowledge sharing behavior (see Figure 2.2).

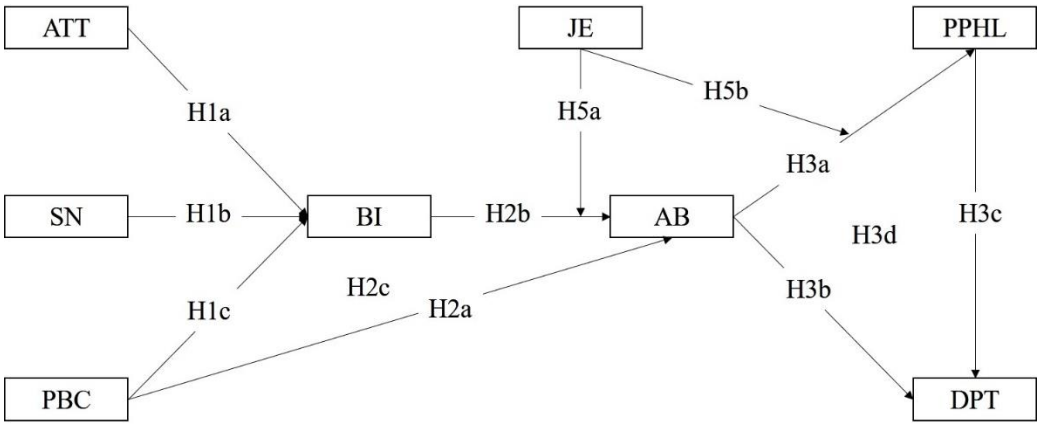

Figure 2.2 Hypothesized model

Note: ATT = attitudes toward knowledge sharing, SN = subjective norms for knowledge sharing, PBC = perceived behavioral control for knowledge sharing, BI = behavioral intention to knowledge sharing, AB = actual behavior of knowledge sharing, JE = job effort, PPHL = perceived patient health literacy, DPT: doctor-patient trust; H4a = H1a + H2b + H3a + H3c; H4b = H1b + H2b + H3a + H3c; H4c = H1c + H2b + H3a + H3c.

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Chapter 3: Research Methods

This chapter introduces the components of the questionnaire, its implementation steps, and the quality control measures. It also provides detailed results of the reliability analysis, validity analysis, and common method bias analysis.

3.1 Questionnaire design

This study designed a survey questionnaire to measure the attitudes, practices, and behaviors of Chinese chronic disease doctors in sharing medical knowledge. The scales were adapted to ensure comprehensibility and validity for Chinese doctors.

3.1.1 Components of the questionnaire

A questionnaire was developed for data collection. It includes a basic information section covering department, daily outpatient volume, proportion of long-term follow-up patients, gender, age, tenure, marital status, education level, professional title, number of beds in the hospital, and the hospital's name. The preface of the questionnaire included an informed consent form and emphasized that the respondents must be chronic disease doctors. It specified that the "patients" referred to in the questionnaire were "long-term follow-up chronic disease patients." To ensure data quality, three attention-check items with deliberately incorrect statements (e.g., "AIDS is not a contagious disease") were included. All items were measured on a six-point Likert scale. Unless specified, the scores range from 1 = "Strongly disagree" to 6 "Strongly agree". In addition, context descriptions were prefixed to the items to help respondents relate to the scenarios of sharing medical knowledge with patients.

3.1.2 Measurement of doctors' attitudes toward knowledge sharing

Ajzen (2020) pointed out that no questionnaire based on Theory of Planned Behavior (TPB) could universally apply to all behaviors, populations, and periods of time, but the established questionnaires could serve as references. Drawing systematically on prior empirical literature and deliberately contextualized to contemporary China, this study rigorously developed a scale for doctors' attitudes toward knowledge sharing. Doctors' attitudes toward knowledge sharing

refer to their overall evaluation of sharing medical knowledge with patients, including beliefs about positive or negative outcomes and personal assessments of these outcomes. Given the non-negligible influence of attitudes toward knowledge sharing in clinical practice, its precise and comprehensive measurement is imperative. This study takes into account the unique characteristics of the healthcare setting to ensure that the instrument comprehensively captures the attitudes involved in knowledge sharing between doctors and patients. All items explicitly refer to knowledge sharing between doctors and patients. This scale uses bipolar adjectives (e.g., 1 = "Very harmful", 6 = "Very beneficial").

3.1.3 Measurement of doctors' subjective norms for knowledge sharing

Doctors' subjective norms for knowledge sharing refer to doctors' perceived social pressure or expectations, i.e., the extent to which significant others (e.g., colleagues, patients) expect them to share medical knowledge with patients. Drawing systematically on prior empirical literature and deliberately contextualized to contemporary China, this study rigorously developed a scale for doctors' subjective norms for knowledge sharing. This study takes into account the unique characteristics of the healthcare setting to ensure that the instrument comprehensively captures the subjective norms involved in knowledge sharing between doctors and patients. All items explicitly refer to knowledge sharing between doctors and patients.

3.1.4 Measurement of doctors' perceived behavioral control for knowledge sharing

Doctors' perceived behavioral control for knowledge sharing refers their perceived ability to successfully share knowledge with patients, considering resources, time, skills, and environmental factors. Drawing systematically on prior empirical literature and deliberately contextualized to contemporary China, this study rigorously developed a scale for doctors' perceived behavioral control for knowledge sharing. This study takes into account the unique characteristics of the healthcare setting to ensure that the instrument comprehensively captures the perceived behavioral control involved in knowledge sharing between doctors and patients. All items explicitly refer to knowledge sharing between doctors and patients.

3.1.5 Measurement of doctors' behavioral intention to knowledge sharing

Behavioral intention refers to individuals' motivation and willingness to perform a specific behavior and serves as an antecedent to the actual behavior. Doctors' behavioral intention to knowledge sharing refers to their intention or plan to share medical knowledge with patients

based on their attitudes, subjective norms, and perceived behavioral control. Drawing systematically on prior empirical literature and deliberately contextualized to contemporary China, this study rigorously developed a scale for doctors' behavioral intention to knowledge sharing. This study takes into account the unique characteristics of the healthcare setting to ensure that the instrument comprehensively captures the behavioral intention involved in knowledge sharing between doctors and patients. All items explicitly refer to knowledge sharing between doctors and patients.

3.1.6 Measurement of doctors' actual behavioral of knowledge sharing

Based on the 6-item scale for knowledge sharing behavior between employees in Bock and Kim (2002) and the 5-item scale developed by Chatzoglou and Vraimaki (2009), in this study, items for the behavior of knowledge sharing were described as specific actions, such as "manuals, methods, models", "experiences, techniques", and "self-education and professional training knowledge". Therefore, in this study, the actual behavior of knowledge sharing by doctors refers to the specific actions in clinical practice where doctors share medical knowledge with patients, such as providing detailed explanations of medical conditions and using educational materials. Drawing systematically on prior empirical literature and deliberately contextualized to contemporary China, this study rigorously developed a scale for actual behavioral of knowledge sharing. This study takes into account the unique characteristics of the healthcare setting to ensure that the instrument comprehensively captures the actual behavioral involved in knowledge sharing between doctors and patients. All items explicitly refer to knowledge sharing between doctors and patients.

3.1.7 Measurement of perceived patient health literacy

In today's complex and dynamic healthcare environment, enhancing patient health literacy is of paramount importance. In clinical practice, when dealing with patients who are chronically ill, doctors have a responsibility to share medical knowledge and to flexibly and appropriately adjust their interaction styles during communication. This knowledge sharing behavior can be regarded as a core component of continuous chronic disease care and is conducive to promoting patients' self-management of health and long-term health outcomes. Drawing on prior literature and tailored to the specific context of China's healthcare environment, this study developed a scale for perceived patient health literacy. The scale is designed to comprehensively reflect doctors' perceptions of their patients' health literacy.

3.1.8 Measurement of doctor-patient trust

This study chose chronic disease doctors as the research subject and adopted the narrow definition of doctor-patient relationships, specifically the interactions between doctors and patients in hospital consulting rooms. In this study, trust was chosen as a variable to measure the quality of doctor-patient relationships, as it may more effectively reflect the quality of the relationship after doctors' knowledge sharing. For chronic diseases, the trust between chronic disease doctors and their patients plays a significant role in long-term health management. The scale of Doctor-Patient Relationship in China (DRP-C) in Zeng et al. (2022); Zeng et al. (2023) is suitable for surveys with doctors as the target. It includes two dimensions: (1) mutual trust between the patient and doctor; and (2) patient-centered treatment. In this study, four items from the "doctor-patient trust" dimension were selected to measure the doctor's perception of the trust patients have in them.

3.1.9 Measurement of job effort

TPB focuses on predicting a specific target behavior and does not account for healthcare professionals' other related concurrent behaviors in healthcare (Presseau et al., 2011). For Chinese doctors, knowledge sharing may not be their consistent goal commitment amongst their numerous clinical tasks. High job effort may suppress their performance (Ji et al., 2023), affecting both the implementation process and outcome evaluations of the behavior. Intensive workloads expose doctors to daily tasks such as numerous patient consultations, complex diagnoses, and emergency interventions. Time constraints make it challenging for doctors to engage in systematic and in-depth knowledge sharing activities. Ineffective knowledge sharing can harm doctor-patient interactions, leading to patient misconceptions or insufficient understanding of their conditions and feelings of confusion and helplessness during treatment. Grounded in prior literature and adapted to China's healthcare context, this study developed a scale for job effort that captures the time pressure, frequent interruptions, and workplace stress doctors face.

3.2 Sampling and procedure

This study employed convenience sampling and snowball sampling methods to survey chronic disease doctors in China to ensure sample diversity and representativeness. We first constructed a preliminary sample consisting of doctors from the target departments. A face-to-face survey

was employed to directly communicate with target doctors and collect information about their views, attitudes, and practices regarding the research topic. During the face-to-face interactions with the preliminary sample, doctors were asked to recommend other doctors who meet the selection criteria. These recommended doctors were then included in the new sample pool. The newly surveyed doctors were further asked to recommend other eligible doctors. In this way, the sample scope gradually expanded. The screening and survey steps were repeated until the required sample size was reached, at which point the sampling process was terminated. Following empirical estimation methods, we determined the appropriate sample size for statistical analysis by multiplying the total number of questionnaire items by 10. Additionally, considering a 20% non-response rate, the sample size required for the survey was finally determined.

Respondents participated voluntarily, and their informed consent was obtained before filling out the questionnaire. All responses were treated with strict confidentiality. A pilot test was conducted before the formal survey. The survey covered six provinces (Shanghai, Guangdong, Jiangsu, Zhejiang, Hubei, and Anhui), 16 cities (e.g., Guangzhou, Nanjing, Wuhan, Hangzhou), and 39 hospitals. A total of 678 questionnaires were collected, exceeding the required sample size.

The formal survey was conducted between March 20, 2024, and April 30, 2024. To ensure data accuracy, all interviewers underwent professional training. In data collection, parallel double-entry and cross-verification were performed by two interviewers to minimize human error and prevent data loss. After applying the quality control standards, we obtained 607 valid questionnaires, while 71 were deemed invalid, yielding an effective rate of 89.5%.

3.3 Quality control

Given that all scales were adapted from well-established scales in previous studies, this research followed a translation and back-translation process to develop a Chinese version that maintained the original item content while ensuring conceptual consistency in the specific cultural context. To ensure data quality and the reliability of subsequent analyses, rigorous criteria for sample screening were developed based on the research objectives through discussion with the author's colleagues and peers. The exclusion criteria include the following: the hospital name was not provided; the respondent worked at a private hospital; the daily outpatient volume was reported as "0"; the proportion of long-term follow-up patients was reported as "0"; the department was unrelated to chronic diseases; any attention-check question

was answered incorrectly; inconsistencies were found between the respondent's age, education level, and tenure; the same option was selected for all items in the questionnaire. If a questionnaire met any of these criteria, it was deemed invalid (see Figure 3.1). During sample screening, this study employed the cross-verification (with two interviewers) to ensure the screening accuracy. In addition, we adopted anonymous responses, randomized the items, and avoided neutral statements. These measures collectively ensured high data quality and reliability for subsequent analyses.

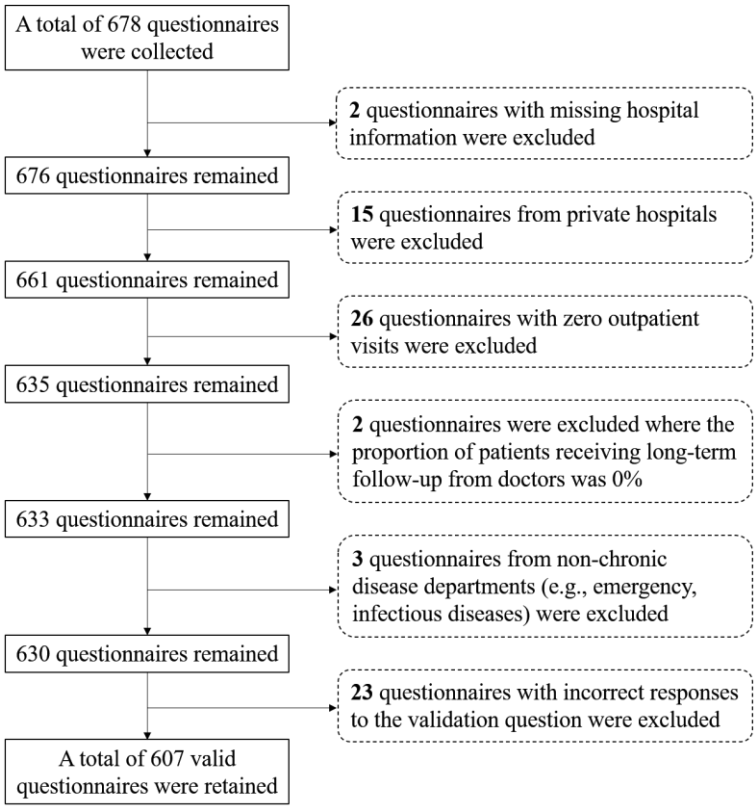

Figure 3.1 Sample screening procedure

3.4 Statistical analysis methods

This study employed SPSS 26.0 for descriptive analysis, correlation analysis, and analysis of variance (ANOVA). Mplus 8.3 was used to construct a structural equation model (SEM) to test all research hypotheses. Prior to these analyses, we first carried out reliability analysis, validity analysis, and common method bias analysis on the data.

3.4.1 Reliability analysis

Reliability measures the internal consistency of items in a scale. Cronbach's α is a commonly used indicator with a threshold of .7 for acceptability (Cortina, 1993). In general, Corrected

Item-Total Correlation (CITC) of .4 is considered acceptable (Kovačić & Ковачић, 1994). If Cronbach's α increases after removing an item, it indicates improved reliability without that item (Francis & Field, 2011). When the overall results fall within the acceptable range, the decision to retain or delete an item was made through a comprehensive evaluation based on both data analysis and theoretical justifications (Schmitt, 1996).

3.4.2 Validity analysis

Exploratory factor analysis (EFA) was employed to identify and interpret relationships among observed variables, grouping them into underlying latent factors. In this study, principal component analysis (PCA) with varimax rotation was used to extract factors, adhering to the original scale standards. If the Kaiser-Meyer-Olkin (KMO) value exceeded .6 and Bartlett's test of sphericity was statistically significant ($p < .05$), the data were deemed suitable For EFA (Bartlett, 1954; Kaiser, 1974). Factors with communalities above .4 were deemed acceptable (Velicer & Fava, 1998), and the total variance explained by the factors needed to exceed 50% (Streiner, 1994). Factor loadings greater than .4 after rotation were considered satisfactory (Stevens, 2002).

Confirmatory factor analysis (CFA) was employed to examine the model' construct validity and convergent validity. Construct validity is usually assessed through indices such as the Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and Comparative Fit Index (CFI). Convergent validity is generally established through factor loadings, average variance extraction (AVE), and composite reliability (CR), with thresholds set at > .4 for standardized factor loadings (De Smedt et al., 2013), > .5 for AVE (Choshin & Ghaffari, 2017), and > .6 for CR (Fornell & Larcker, 1981). The square root of the AVE for each variable being greater than the correlation coefficients between that variable and all other variables indicates that the variable has good discriminant validity in measuring its corresponding construct.

3.4.3 Common method bias analysis

Common method bias refers to the artificial covariance between predictor variables and criterion variables that arises due to the same data source or respondent, the same measurement environment, or the specific context and characteristics of the items. To address common method bias, this study employed procedural controls during research design and measurement, such as anonymous participation, randomizing the order of measurement items, and avoiding

the use of neutral statements. To statistically examine common method bias, Harman's single-factor test was conducted. If the variance explained by the first factor is less than 40%, it is concluded that common method bias is not a significant concern (Harman, 1976).

3.4.4 Descriptive analysis

This study used frequency analysis to examine demographic variables, calculating the frequency and percentage for each category. Continuous variables, such as daily outpatient volume, the proportion of long-term follow-up patients received daily, and the number of beds in the hospital, were divided into quartiles based on their interquartile ranges for analysis.

3.4.5 Correlation analysis

For data that met the assumptions of normal distribution, Pearson correlation was used to analyze the relationships between variables. The Pearson correlation coefficient (r) ranges from -1 to 1, where $r > 0$ indicates a positive linear relationship between two variables, and $r < 0$ indicates a negative linear relationship. The closer the value of r is to 0, the weaker the linear relationship. Conversely, values closer to -1 or +1 represent stronger relationships. If $r = 0$, it indicates no linear relationship between the variables (Lee Rodgers & Nicewander, 1988).

3.4.6 Analysis of variance (ANOVA)

This study employed independent-sample t-tests to compare the means of two samples derived from different populations, aiming to determine whether there is a significant difference in their means. When the assumption of homogeneity of variance was met, a standard t-test was employed. Additionally, ANOVA was conducted to assess whether there were significant differences in the dependent variable's means across three or more levels of demographic characteristics. Before performing one-way ANOVA, the data were tested for normality and homogeneity of variance. If the data met the assumption of normality but not homogeneity of variance, Welch's variance test was employed. When the results of ANOVA indicated significant differences between groups, post-hoc multiple comparison tests were conducted. Bonferroni correction was used if the assumption of homogeneity of variance was satisfied, while Games-Howell was applied in cases where this assumption was not met.

3.4.7 Structural equation modeling (SEM)

This study constructed an SEM using Mplus 8.3 to examine the research hypotheses. Model fit

was assessed using various indices, including the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), chi-square (χ^2), degrees of freedom (df), CFI, TLI, RMSEA, and SRMR. Among these, the chi-square to degrees of freedom ratio (χ^2/df) is sensitive to sample size (Tay & Drasgow, 2012), and lower AIC and BIC values indicate a better fit between the model and the data (Hurvich & Tsai, 1989; Schwarz, 1978). Generally, CFI and TLI values greater than .90 are considered good, while values approaching .90 are deemed acceptable (Hu & Bentler, 1999). RMSEA and SRMR values below 0.10 are considered acceptable (Grunert, 1997; Hu & Bentler, 1999). To further evaluate the robustness of the statistics and to assess their sampling distributions, this study employed the bootstrap resampling method, performing 5000 iterations of resampling from the original dataset.

3.5 Validity analysis

This study performed EFA followed by CFA to examine the construct validity and convergent validity of the scales.

3.5.1 Construct validity test

The study employed the KMO and Bartlett's test of sphericity to assess whether the sample data were suitable for factor analysis. As shown in Table A.1 in Annex A, the KMO values of all variables were greater than the acceptable threshold of .6, indicating high inter-item correlations, suggesting that the data were suitable for factor analysis (Kaiser, 1974). In addition, the results of Bartlett's test of sphericity showed that the correlation matrix of the variables significantly deviated from an identity matrix ($p < .001$), further supporting the data's suitability for factor analysis (Bartlett, 1950).

The eigenvalues of the first factors for attitudes to knowledge sharing (ATT), subjective norms (SN), perceived behavioral control (PBC), behavioral intention (BI), actual behavior (AB), perceived patient health literacy (PPHL), doctor-patient trust (DPT), and job effort (JE) ranged between 2.324 and 3.457, with cumulative variance explained ranging from 58.103% to 81.641%. The communalities of all variables ranged between .363 and .849, which were close to or exceeded the acceptable threshold of .4. Furthermore, the rotated factor loadings ranged between .603 and .921, all surpassing the acceptable threshold of .4.

3.5.2 Convergent validity test

In this study, we employed CFA to assess convergent validity. As shown in Table A.2 in Appendix A, the standardized factor loadings of all variables ranged between .410 and .931, exceeding the acceptable threshold of .4. Moreover, the AVE values for these variables ranged from .444 to .726, surpassing the recommended threshold of .4. Additionally, the CR values ranged between .743 and .889, all above the recommended threshold of .7. Therefore, all variables demonstrated good convergent validity.

3.5.3 CFA on multi-factor models

As shown in Table A.3 in Annex A, among the hypothesized models, the 8-factor model outperformed all alternative models. This result demonstrated good discriminant validity among the variables.

3.5.4 Evaluation of model fit indices

Building on CFA, this study further evaluated the model fit for each variable. Except for the three items measuring job effort ($df = 0$), which formed a saturated model, the overall model fit indices for the remaining variables were all close to or met acceptable thresholds. Considering that all items were adapted from well-established scales and comprehensively represented the conceptual dimensions of the variables, we decided to retain all items of the scales.

3.6 Reliability analysis

This study used Cronbach's α and CITC to evaluate the reliability of the scales. As shown in Table A.4 in Annex A, the Cronbach's α coefficients for all variables ranged from .750 to .887, exceeding the recommended threshold of .7. This indicates high internal consistency among the items within each scale. When any single item was deleted, the Cronbach's α coefficients for the variables ranged from .665 to .901. The minimal changes in Cronbach's α after item deletion suggest that all items could be retained. The CITC values for the items ranged between .466 and .843, all surpassing the recommended threshold of .4. This demonstrates good correlations between each item and the corresponding variable. Therefore, all scales exhibited good reliability.

3.7 Common method bias analysis

To mitigate the potential influence of common method bias, this study implemented procedural controls during data collection, including anonymous responses, randomized ordering of measurement items, and avoidance of neutral statements. Despite these measures, the self-reported nature of the data still presented a potential risk of common method bias. To address this, we employed Harman's single-factor test Harman (1976) to assess whether common method bias was present. We loaded all variables to EFA to determine the number of factors required to explain the variance in the variables (Podsakoff et al., 2003). The results showed that the first principal component explained only 31.156% of the variance, which is below the recommended threshold of 40%. This indicates that there was no serious common method bias in the data.

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Chapter 4: Results

This chapter primarily presents the results of the descriptive analysis, correlation analysis, difference analysis, and structural equation modeling (SEM) validation. Through these analyses, the chapter will delve into the characteristics of the research variables, their relationships, differences across demographic groups, and the degree of support for the theoretical model.

4.1 Descriptives of demographic characteristics

As shown in Table 4.1, female doctors slightly outnumbered male doctors, accounting for 57.8% (n = 351) of the sample. The age and tenure of the sample were relatively balanced, with each age group making up between 23.2% and 28.0%, and each tenure group representing between 21.7% and 29.5%. The majority of the doctors were married, accounting for 83.0% (n = 504) of the sample. Doctors with a master's degree or higher were the majority, accounting for 75.8% (n = 460). In terms of professional titles, attending physicians and associate chief physicians were slightly more prevalent, accounting for 37.2% (n = 226) and 31.3% (n = 190), respectively. Doctors with an outpatient volume of ≤30 patients per day made up the largest proportion, with 34.9% (n = 212). The doctors with ≤20% of their patients under long-term follow-up were slightly more prevalent, accounting for 31.6% (n = 192). Doctors working in hospitals with ≤1000 beds, whether authorized or staffed beds, also made up the largest proportion, representing 33.9% (n = 206) and 33.3% (n = 202), respectively. Most of the doctors are from the departments of cardiology, respiratory medicine, and endocrinology, with a proportion of 24.2% (n = 147), 21.4% (n = 130), and 21.8% (n = 132), respectively.

Table 4.1 Demographic statistical analysis

	Options	Frequency	Percentage (%)
Gender	Male	256	42.2
	Female	351	57.8
Age (years)	≤ 33	170	28.0
	34 - 37	141	23.2
	38 - 42	147	24.2
	≥ 43	149	24.5
Tenure (years)	≤ 6	154	25.4
	7 - 12	179	29.5
	13 - 18	132	21.7
	≥ 19	142	23.4
Marital status	Married	504	83.0

	Options	Frequency	Percentage (%)
	Single	102	16.8
	Other (e.g., divorced)	1	.2
Edcation level	Bachelor's degree	147	24.2
	Master's degree	358	59.0
	Doctorate	102	16.8
Professional title	Resident physician	102	16.8
	Attending physician	226	37.2
	Associate chief physician	190	31.3
	Chief physician	89	14.7
Outpatient volume (number of visits)	≤ 30	212	34.9
	31 - 50	152	25.0
	51 - 70	106	17.5
	≥ 71	137	22.6
Proportion of long-term follow-up patients (%)	≤ 20	192	31.6
	21 - 40	146	24.1
	41 - 60	148	24.4
	≥61	121	19.9
Number of authorized beds	≤ 1000	206	33.9
	1001 - 1200	101	16.6
	1201 - 2050	156	25.7
	≥2051	144	23.7
Number of staffed beds	≤ 1000	202	33.3
	1001 - 1500	163	26.9
	1501 - 2644	114	18.8
	≥2645	128	21.1
Department	Cardiology	147	24.2
	Respiratory medicine	130	21.4
	Endocrinology	132	21.8
	Other chronic diseases	198	32.6

4.2 Correlation between variables

There was a significant positive relationship between attitudes toward knowledge sharing (ATT) and behavioral intention to knowledge sharing (BI) (r = .542, $p < .01$). Subjective norms for knowledge sharing (SN) were also significantly positively related to behavioral intention to knowledge sharing (BI) (r = .577, $p < .01$). Perceived behavioral control for knowledge sharing (PBC) was significantly positively related to both BI (r = .454, p < .01) and the actual behavior of knowledge sharing (AB) (r = .305, $p < .01$). AB was significantly positively related to perceived patient health literacy (PPHL) (r = .310, $p < .01$) and doctor-patient trust (DPT) (r = .422, $p < .01$). Additionally, PPHL was significantly positively associated with DPT (r = .460, $p < .01$). Moreover, there was a significant negative relationship between job effort (JE) and PPHL (r = -.148, p < .01). JE was also negatively associated with several other variables, suggesting that it may have a different influencing mechanism from other variables (see Table 4.2). Therefore, it is relevant to further explore the moderation effect of job effort. In addition,

the square root of the AVE for each variable was greater than the correlation coefficients between that variable and all other variables, indicating good discriminant validity.

Table 4.2 Correlation analysis between variables

	Mean (S.D.)	ATT	SN	PBC	BI	AB	PPHL	DPT	JE
ATT	5.327 (.701)	***(.768)***							
SN	5.111 (.574)	.467**	***(.765)***						
PBC	4.864 (.713)	.433**	.429**	***(.665)***					
BI	5.003 (.733)	.542**	.577**	.454**	***(.811)***				
AB	4.638 (.841)	.356**	.475**	.305**	.524**	***(.787)***			
PPHL	3.834 (.832)	.251**	.279**	.249**	.274**	.310**	***(.815)***		
DPT	4.894 (.586)	.345**	.394**	.402**	.379**	.422**	.460**	***(.796)***	
JE	4.591 (1.013)	-.130**	-.078	-.013	-.040	-.039	-.148**	-.126**	***(.852)***

Note: ** indicates that the two variables are significantly related (p = .01, two-tailed). AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

4.3 Differences in variables across demographic groups

This study employed independent samples t-test and analysis of variance (ANOVA) to examine the differences in each research variable across demographic groups. In the independent samples t-test, when the assumption of homogeneity of variance was met ($p > .05$), we further tested the significance of mean differences. For ANOVA, when the data met the assumption of homogeneity of variance, ANOVA was performed; when the data did not meet this assumption, Welch's t-test was performed. Additionally, Bonferroni correction (for data meeting the homogeneity of variance) or Games-Howell method (for data not meeting the homogeneity of variance) was employed for post-hoc multiple comparisons.

4.3.1 Gender and marital status

We first analyzed the differences in the research variables between doctor groups based on gender and marital status. The assumption of homogeneity of variance for all research variables was met ($p > .05$ overall). As shown in Table 4.3, female doctors exhibited significantly higher BI (Mean = 20.236) than male doctors (Mean = 19.707). However, no significant differences were found for other variables across gender groups. Furthermore, no significant differences were found in any research variables between doctor groups with different marital statuses.

Table 4.3 ANOVA by gender and marital status

Variable	Group	Mean	SD	Levene's test		t-test		Mean difference
				t	*p*	t	*p*	
ATT	Female	26.573	3.642	.049	.824	-.520	.603	.150
	Male	26.723	3.312					
	Married	26.734	3.365	2.022	.156	1.529	.127	.579

Variable	Group	Mean	SD	Levene's test		t-test		Mean difference
				t	*p*	t	*p*	
SN	Single	26.155	4.103	.308	.579	1.436	.151	.339
	Female	25.698	2.907					
	Male	25.359	2.815					
	Married	25.536	2.880	.198	.657	-.369	.712	.114
	Single	25.650	2.838					
PBC	Female	19.342	2.895	.260	.611	-1.142	.254	.267
	Male	19.609	2.787					
	Married	19.544	2.874	.085	.771	1.703	.089	.525
	Single	19.019	2.704					
BI	Female	20.236	2.854	.524	.469	2.204	.028	.529
	Male	19.707	3.014					
	Married	20.044	2.855	1.439	.231	.566	.572	.180
	Single	19.864	3.293					
AB	Female	23.179	4.276	.188	.665	-.057	.955	.020
	Male	23.199	4.108					
	Married	23.242	4.169	.219	.640	.703	.482	.320
	Single	22.922	4.374					
PPHL	Female	15.239	3.206	2.837	.093	-.824	.410	.226
	Male	15.465	3.490					
	Married	15.242	3.291	.379	.538	-1.514	.130	.544
	Single	15.786	3.486					
DPT	Female	19.513	2.273	.778	.378	-.764	.445	.147
	Male	19.660	2.443					
	Married	19.635	2.268	3.504	.062	1.395	.164	.353
	Single	19.282	2.684					
JE	Female	13.823	2.999	.491	.484	.481	.631	.120
	Male	13.703	3.101					
	Married	13.813	2.994	1.574	.210	.732	.465	.240
	Single	13.573	3.265					

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

4.3.2 Professional title

For differences between doctor groups with different professional titles, based on the results of the homogeneity of variance test, except for DPT, which was analyzed using Welch's t test, the remaining research variables were analyzed using ANOVA.

There were significant differences in PBC and DPT between doctor groups with different professional titles. Based on the results of the homogeneity of variance test, post-hoc multiple comparison analysis using Bonferroni correction showed that PBC of resident physicians (Mean = 18.510) was significantly lower than that of doctors with the other three professional titles, including chief physicians (Mean = 19.764), attending physicians (Mean = 19.504), and associate chief physicians (Mean = 19.758). Additionally, based on the homogeneity of variance test results, post-hoc multiple comparisons using the Games-Howell method showed that DPT of resident physicians (Mean = 18.873) was significantly lower than that of associate chief

physicians (Mean = 19.663) and chief physicians (Mean = 20.382); DPT of attending physicians (Mean = 19.500) was significantly lower than that of chief physicians (Mean = 20.382). Apart from these, no significant differences were found in the other variables across doctor groups with different professional titles (see Table 4.4).

Table 4.4 ANOVA by professional title

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
PBC	1	19.764	3.015	.217	.884	4.918	.002	1, 2, 3＞4
	2	19.504	2.765					
	3	19.758	2.816					
	4	18.510	2.792					
DPT	1	20.382	2.456	2.794	.040	6.205	.001	1, 3＞4 1＞2
	2	19.500	2.421					
	3	19.663	2.027					
	4	18.873	2.428					

Note: 1: chief physician; 2: attending physician; 3: associate chief physician; 4: resident physician; DPT = doctor-patient trust; PBC = perceived behavioral control for knowledge sharing.

4.3.3 Outpatient volume

Regarding differences between doctor groups with different outpatient volumes, based on the results of the homogeneity of variance test, except for JE, which was analyzed using Welch's t test, the other variables were all analyzed using ANOVA.

Significant differences were found in AB across doctor groups with different outpatient volumes. Specifically, according to the results of the homogeneity of variance test, post-hoc multiple comparisons using Bonferroni correction showed that AB of doctors with an outpatient volume of ≥71 visits (Mean = 22.255) was significantly lower than that of doctors with an outpatient volume of 31-50 (Mean = 23.697) and ≤30 visits (Mean = 23.698). Apart from this, no significant differences were found in other variables across doctor groups with different outpatient volumes (Table 4.5).

Table 4.5 ANOVA by outpatient volume

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
AB	1	22.255	4.123	1.977	.116	4.717	.003	3, 4＞1
	2	22.642	4.148					
	3	23.697	3.869					
	4	23.698	4.397					

Note: 1: ≥71%; 2: 51-70%; 3: 31-50%; 4: ≤30%; AB = actual behavior of knowledge sharing.

4.3.4 Proportion of long-term follow-up patients

As to differences between doctor groups with different proportions of long-term follow-up

patients, based on the results of the homogeneity of variance test, except for SN and AB, which were analyzed using Welch's t test, the other variables were analyzed using ANOVA.

There were significant differences in AB and DPT across doctor groups with different proportions of long-term follow-up patients. Specifically, according to the results of the homogeneity of variance test, post-hoc multiple comparisons using the Games-Howell method showed that AB of doctors with a long-term follow-up patient proportion of ≤20% (Mean = 22.557) was significantly lower than that of doctors with a long-term follow-up patient proportion of ≥61% (Mean = 23.860). Furthermore, according to the results of the homogeneity of variance test, post-hoc multiple comparisons using Bonferroni correction showed that doctors with a long-term follow-up patient proportion of ≤20% (Mean = 19.203) reported significantly lower DPT compared to doctors with a long-term follow-up patient proportion of 41%-60% (Mean = 19.912). Apart from these, no significant differences were found in other variables across doctor groups with different proportions of long-term follow-up patients (see Table 4.6).

Table 4.6 ANOVA by proportion of long-term follow-up patients

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
AB	1	23.622	4.154	2.905	.034	2.904	.035	4＞3
	2	23.021	3.704					
	3	22.557	4.535					
	4	23.860	4.170					
DPT	1	19.912	2.318	.282	.068	2.857	.036	1＞3
	2	19.726	2.080					
	3	19.203	2.397					
	4	19.570	2.536					

Note: 1: 41%-60%; 2: 21%-40%; 3: ≤20%; 4: ≥61%; AB = actual behavior of knowledge sharing; DPT = doctor-patient trust.

4.3.5 Age

The ANOVA results showed that ATT, PBC, DPT, and JE significantly differed across different age groups. Based on the results of the homogeneity of variance test, we conducted post-hoc multiple comparison analysis using Bonferroni correction. Doctors aged 33 or below (Mean = 26.035) reported significantly lower ATT compared to doctors aged 43 or above (Mean = 27.114). Doctors aged 33 or below (Mean = 18.635) also reported significantly lower PBC than doctors aged 43 or above (Mean = 19.946), 38-42 (Mean = 19.796), and 34-37 (Mean = 19.567). Doctors aged 43 or above (Mean = 20.208) reported significantly higher DPT than doctors aged 34-37 (Mean = 19.461) and those aged 33 or below (Mean = 19.082). Furthermore, doctors aged 33 or below (Mean = 13.241) showed significantly lower JE than doctors aged 38-42

(Mean = 14.265). Apart from these, no significant differences were found in other variables across different age groups (see Table 4.7).

Table 4.7 ANOVA by age

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
ATT	1	26.702	3.376	.391	.760	2.714	.044	2＞4
	2	27.114	3.187					
	3	26.782	3.536					
	4	26.035	3.784					
PBC	1	19.567	2.689	.310	.818	7.146	<.001	1, 2, 3＞4
	2	19.946	2.931					
	3	19.796	2.760					
	4	18.635	2.836					
DPT	1	19.461	2.222	.753	.521	6.411	<.001	2＞1, 4
	2	20.208	2.355					
	3	19.612	2.231					
	4	19.082	2.421					
JE	1	13.851	2.878	1.441	.230	3.093	.027	3＞4
	2	13.819	2.952					
	3	14.265	2.917					
	4	13.241	3.284					

Note: 1: 34-37 years; 2: ≥43 years; 3: 38-42 years; 4: ≤33 years; ATT = attitudes toward knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing.

4.3.6 Tenure

ANOVA results showed significant differences in PBC, DPT, and JE across different tenure groups. Based on the results of the homogeneity of variance test, we performed post hoc multiple comparison analysis using Bonferroni correction. Doctors with ≤6 years of tenure (Mean = 18.474) reported significantly lower PBC compared to doctors with 13-18 years of tenure (Mean = 19.992), ≥19 years of tenure (Mean = 19.817), and those with 7-12 years of tenure (Mean = 19.615). Doctors with ≥19 years of tenure (Mean = 20.204) reported significantly higher DPT than those with 7-12 years of tenure (Mean = 19.469) and ≤6 years of tenure (Mean = 19.013). Moreover, doctors with ≤6 years of tenure (Mean = 13.143) showed significantly lower JE compared to those with 13-18 years of tenure (Mean = 14.167). However, other research variables did not show significant differences across different tenure groups (see Table 4.8).

Table 4.8 ANOVA by tenure

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
PBC	1	19.615	2.801	2.537	.056	8.930	<.001	1, 2, 3＞4
	2	19.817	3.005					
	3	19.992	2.442					

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
DPT	4	18.474	2.875	1.873	.133	6.786	<.001	2＞1, 4
	1	19.469	2.291					
	2	20.204	2.351					
	3	19.697	2.111					
	4	19.013	2.460					
JE	1	14.017	3.018	.733	.532	3.366	.018	3＞4
	2	13.782	3.018					
	3	14.167	2.813					
	4	13.143	3.200					

Note: 1: 7-12 years; 2: ≥19 years; 3: 13-18 years; 4: ≤6 years; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing.

4.3.7 Number of authorized beds

ANOVA results showed significant differences in SN, BI, AB, and JE by the number of authorized beds. Based on the results of the homogeneity of variance test, we conducted post hoc multiple comparison analysis using Bonferroni correction. Doctors in hospitals with ≤1000 authorized beds reported significantly higher SN (Mean = 25.971) compared to doctors in hospitals with 1001-1200 authorized beds (Mean = 25.020) and those in hospitals with ≥2051 authorized beds (Mean = 25.062). Doctors in hospitals with ≥2051 authorized beds (Mean = 19.292) showed significantly lower BI than doctors in hospitals with ≤1000 authorized beds (Mean = 20.214) and those in hospitals with 1201-2050 authorized beds (Mean = 20.500). In addition, doctors in hospitals with ≥2051 authorized beds (Mean = 21.729) showed significantly lower AB than doctors in hospitals with ≤1000 authorized beds (Mean = 23.825) and those in hospitals with 1201-2050 authorized beds (Mean = 23.737). Although the ANOVA results showed significant differences in JE across doctor groups in hospitals with different numbers of authorized beds (p = .026), through post hoc multiple comparisons, we only found a marginally significant difference in JE between doctors in hospitals with ≤1000 authorized beds and those in hospitals with 1201-2050 authorized beds (p = .055). Other variables did not show significant differences by the number of authorized beds (see Table 4.9).

Table 4.9 ANOVA by number of authorized beds

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
SN	1	25.062	2.749	1.832	.140	4.502	.004	3＞1, 4
	2	25.808	2.808					
	3	25.971	2.915					
	4	25.020	2.902					
BI	1	19.292	2.884	.317	.813	4.818	.003	2, 3＞1
	2	20.500	2.725					
	3	20.214	2.960					

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
AB	4	19.881	3.083	.808	.490	8.570	<.001	2, 3＞1
	1	21.729	4.042					
	2	23.737	4.330					
	3	23.825	4.066					
	4	23.119	4.041					
JE	1	14.118	2.955	.777	.507	3.102	.026	2＞3
	2	14.154	2.934					
	3	13.316	3.193					
	4	13.624	2.901					

Note: 1: ≥ 2051 beds; 2: 1201-2050 beds; 3: ≤1000 beds; 4: 1001-1200 beds; AB = actual behavior of knowledge sharing; BI = behavioral intention to knowledge sharing; JE = job effort; SN = subjective norms for knowledge sharing.

4.3.8 Number of staffed beds

ANOVA results showed that SN, BI, AB, and JE differed significantly across doctor groups in hospitals with different numbers of staffed beds. Based on the results of the homogeneity of variance test, we performed post hoc multiple comparison analysis using Bonferroni correction. Doctors in hospitals with ≥2645 staffed beds (Mean = 25.000) reported significantly lower SN than doctors in hospitals with ≤1000 staffed beds (Mean = 25.941). Doctors in hospitals with ≥2645 staffed beds (Mean = 19.273) showed significantly lower BI than doctors in hospitals with ≤1000 staffed beds (Mean = 20.198) and those in hospitals with 1001-1500 staffed beds (Mean = 20.215). Moreover, doctors in hospitals with ≥2645 staffed beds (Mean = 21.578) showed significantly lower AB than doctors in hospitals with ≤1000 staffed beds (Mean = 23.792), those in hospitals with 1001-1500 staffed beds (Mean = 23.712), and those in hospitals with 1501-2644 staffed beds (Mean = 23.175). Although the ANOVA results showed significant differences in JE across doctor groups in hospitals with different numbers of staffed beds (p = .031), through post hoc multiple comparisons, we only found a marginally significant difference in JE between doctors in hospitals with ≤1000 staffed beds and those in hospitals with 1501-2644 staffed beds (p = .067). Other variables did not show significant differences across doctor groups in hospitals with different numbers of staffed beds (see Table 4.10).

Table 4.10 ANOVA by number of staffed beds

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
SN	1	25.000	2.798	.379	.144	2.841	.037	3＞1
	2	25.535	2.594					
	3	25.941	2.908					
	4	25.528	3.015					
BI	1	19.273	2.910	.475	.699	3.487	.016	3, 4＞1
	2	20.228	2.661					

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
AB	3	20.198	2.979	.500	.682	8.826	<.001	2, 3, 4＞1
	4	20.215	3.004					
	1	21.578	3.997					
	2	23.175	4.108					
	3	23.792	4.089					
	4	23.712	4.271					
JE	1	14.141	2.907	.813	.487	2.973	.031	2＞3
	2	14.228	2.872					
	3	13.327	3.214					
	4	13.718	2.978					

Note: 1: ≥2645 beds; 2: 1501-2644 beds; 3: ≤1000 beds; 4: 1001-1500 beds; AB = actual behavior of knowledge sharing; BI = behavioral intention to knowledge sharing; JE = job effort; SN = subjective norms for knowledge sharing.

4.3.9 Department

For the differences across doctor groups in different departments, based on the results of the homogeneity of variance test, except for ATT, PBC, BI, and JE, which were analyzed using Welch's t test, other variables were analyzed using ANOVA.

Significant differences were found in JE across doctor groups in different departments. Based on the results of the homogeneity of variance test, we performed post hoc multiple comparison analysis using the Games-Howell method. The results showed that doctors in the cardiology department (Mean = 14.408) reported significantly higher JE compared to doctors in other chronic disease departments (Mean = 13.195). Apart from this, no significant differences were found in other variables across doctor groups in different departments (see Table 4.11).

Table 4.11 ANOVA by department

Variable	Group	Mean	SD	Homogeneity of variance test		Variance test		Multiple comparison
				t	*p*	t	*p*	
JE	1	13.795	3.036	4.514	.004	4.514	.004	3＞4
	2	13.895	2.692					
	3	14.408	2.696					
	4	13.195	3.405					

Note: 1: endocrinology department; 2: respiratory medicine department; 3: cardiology department; 4: other chronic disease departments; JE = job effort.

4.4 Summary of differences across demographic groups

Significant differences were found in AB across doctor groups with different outpatient volumes and different proportions of long-term follow-up patients. Doctors with higher

outpatient volumes showed lower AB, while doctors with higher proportions of long-term follow-up patients showed higher AB. Furthermore, PBC, DPT, and JE exhibited significant differences across age and tenure groups: younger doctors with shorter tenure tend to have lower PBC; older doctors with longer tenure tend to show higher DPT; mid-range age and tenure doctors reported higher JE. PBC and DPT also showed significant differences across doctor groups of different professional titles, with doctors of more senior titles reporting higher DPT. Significant differences in SN, BI, AB, and JE are observed across doctors in hospitals with different numbers of authorized or staffed beds. Doctors in smaller hospitals tend to have higher SN, while doctors in larger hospitals showed lower BI and AB. Besides, hospital size also influenced doctors' JE. In addition, significant differences were found in BI between male and female doctors, and ATT differed significantly among different age groups, with doctors aged ≤33 showing the lowest ATT. Furthermore, JE showed significant differences across doctors in different departments. However, no significant differences were found in any variable across doctor groups with different marital statuses or education levels. PPHL did not show significant differences by any demographic characteristic.

4.5 Hypothesized model (M0) testing

In this study, we used Mplus 8.3 for path analysis of the latent variables in the hypothesized model (M0) and two alternative models. This study followed a theory-driven strategy to compare the hypothesized models and identify the most reasonable one. Based on the hypothesized model, we examined the initial fit of the structural model, where the circles represent latent variables, the rectangles represent measurement items, and the residuals point to each measurement item and latent variable (see Figure 4.1). To ensure the robustness of the test results, we performed 5000 Bootstrap resamples to determine the confidence intervals of the key variables.

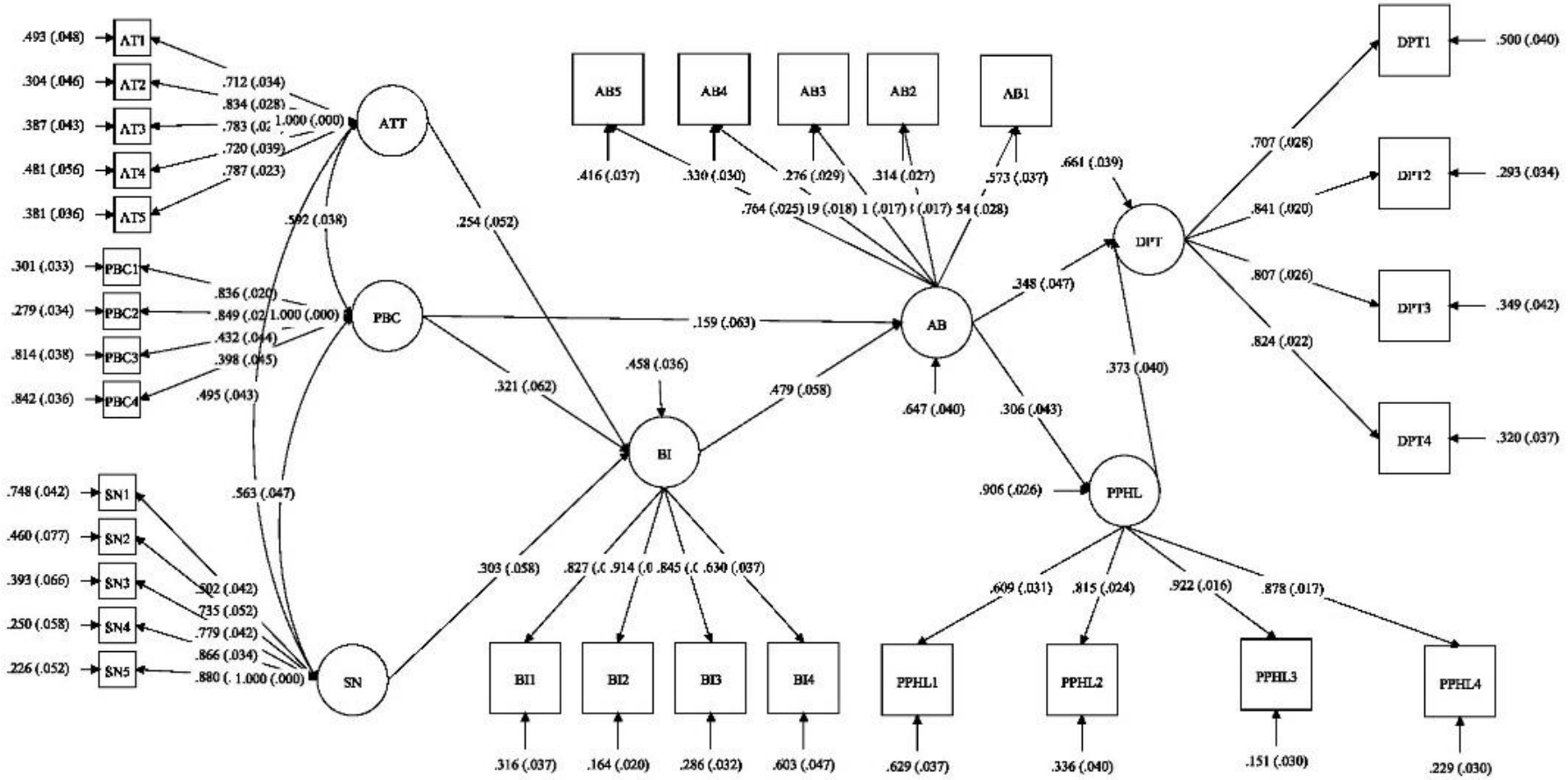

Figure 4.1 Path diagram of M0

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

Based on the original hypothesized model M0, we further constructed models M1 and M2 for comparison. Perceived patient health literacy reflects the immediate effect of doctors' actual behavior of knowledge sharing. However, in comparison, doctor-patient trust is more likely to be a long-term outcome of doctors' knowledge sharing. Therefore, in M1, the path between AB and DPT was removed in an attempt to simplify the model. Furthermore, previous studies have confirmed that patient health literacy may influence the trust relationship between doctors and patients (Luo et al., 2023). At the same time, a good doctor-patient relationship can more effectively facilitate patients' understanding and evaluation of relevant health information (Peltzer et al., 2020; Siembida & Bellizzi, 2015). Therefore, there seems to be a bidirectional reinforcing relationship between patient health literacy and doctor-patient trust. However, the directionality of this relationship may not be consistent through the lens of doctors and patients. From the doctors' perspective, doctor-patient trust may emerge as a positive outcome following the improvement of health literacy. In contrast, from the patients' perspective, when they experience doctor-patient trust, they may be more willing to accept and understand the medical knowledge provided by doctors. Therefore, in M2, the positions of PPHL and DPT in the path were switched, and the path between AB and PPHL was removed. This adjustment aims to clarify the direction of the relationship between patient health literacy and doctor-patient trust from the doctors' perspective.

As shown in Table 4.12, in M0, χ^2/df was 3.582, which falls within the acceptable range. Comparative Fit Index (CFI) was .905, and Tucker-Lewis Index (TLI) was .896, both of which are greater than or close to the acceptable threshold of .9. Root Mean Square Error of Approximation (RMSEA) was .065, and Standardized Root Mean Square Residual (SRMR) was .086, both below the acceptable threshold of .1. The overall fit of M0 was acceptable. Compared to M0, M1 had an increase in Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), an increase in χ^2 and χ^2/df, a decrease in CFI and TLI values, and an increase in RMSEA and SRMR. In M2, χ^2 and χ^2/df increased, as well as the SRMR value. Therefore, both M1 and M2 showed a decrease in overall fit, indicating that the original hypothesized model M0, which includes both direct effects and mediation effects, is superior.

Table 4.12 Comparison of model fit indices

Indices	AIC	BIC	χ^2	Df	χ^2/df	CFI	TLI	RMSEA	SRMR
Criteria	-	-	-	-	<5	> .9	> .9	< .1	< .1
M0	36959	37418	1515	423	3.582	.905	.896	.065	.086
M1	37025	37479	1583	424	3.733	.900	.890	.067	.112
M2	36963	37417	1521	424	3.586	.905	.896	.065	.090

We further examined the direct effects between the variables in the hypothesized model to understand the relationships among them. There was a significant positive relationship between

ATT and BI (β = .254, p < .001). Therefore, hypothesis H1a, "*Doctors' attitudes toward knowledge sharing (ATT) are positively associated with their behavioral intention to knowledge sharing (BI)*", was supported. The results showed a significant positive relationship between SN and BI (β = .303, p < .001). Thus, hypothesis H1b, "*Doctors' subjective norms for knowledge sharing (SN) are positively associated with their behavioral intention to knowledge sharing (BI)*", was supported. PBC was significantly positively associated with BI (β = .321, p < .001). Therefore, hypotheses H1c, "*Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with their behavioral intention to knowledge sharing (BI)*", was supported.

Both PBC and BI showed a significant positive relationship with AB (β = .159, p = .011; β = .479, p < .001). Thus, H2a, "*Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with the actual behavior of knowledge sharing (AB)*", and H2b, "*Doctors' behavioral intention to knowledge sharing (BI) is positively associated with the actual behavior of knowledge sharing (AB)*", were both supported.

AB had a significant positive relationship with both PPHL and DPT (β = .306, p < .001; β = .348, p < .001), supporting H3a, "*Doctors' actual behavior of knowledge sharing (AB) is positively associated with perceived patient health literacy (PPHL)*", and H3b, "*Doctors' actual behavior of knowledge sharing (AB) is positively associated with doctor-patient trust (DPT)*". The results indicated a significant positive relationship between PPHL and DPT (β = .373, p < .001), supporting H3c, "*Perceived patient health literacy (PPHL) is positively associated with doctor-patient trust (DPT)*" (see Table 4.13).

Table 4.13 Path coefficient estimates of M0

Outcome	Predictor	β	SE	β/SE	p	95% CI	
						Lower	Upper
BI	ATT	.254	.052	4.848	<.001	.151	.357
BI	SN	.303	.058	5.231	<.001	.189	.417
BI	PBC	.321	.062	5.203	<.001	.200	.443
AB	BI	.479	.058	8.221	<.001	.365	.593
AB	PBC	.159	.063	2.532	.011	.036	.283
PPHL	AB	.306	.043	7.127	<.001	.222	.390
DPT	AB	.348	.047	7.453	<.001	.256	.439
DPT	PPHL	.373	.040	9.423	<.001	.295	.450

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

For mediation effects, we first examined the path coefficients of the indirect effects and determined whether these path coefficients were significant. When the path coefficients of the indirect effects are significant, it indicates the presence of a mediation effect between the independent and dependent variables; when the path coefficients are not significant, it indicates

no mediation effect. Then, we looked at the direct effect coefficients excluding the influence of the mediators and determined whether these path coefficients were significant. When the path coefficients of the direct effects are significant, it suggests a partial mediation effect between the independent and dependent variables; when the direct effect coefficients are not significant, it indicates a full mediation effect.

As shown in Table 4.14, the standardized path coefficient for the indirect effect of PBC -> BI -> AB was .154 (95% CI [.088, .220], $p < .001$), indicating that BI mediated the relationship between PBC and AB. The standardized path coefficient for the direct effect of PBC -> AB was .159 (95% CI [.036, .283], $p = .011$), suggesting that BI had a partial mediation effect between PBC and AB. Therefore, hypothesis H2c, "*Doctors' behavioral intention to knowledge sharing (BI) mediates the relationship between perceived behavioral control for knowledge sharing (PBC) and actual behavior of knowledge sharing (AB)*", was supported. Decomposing the mediation effect, we found that the mediation effect accounted for 49.20% of the total effect (.154 / .313), while the direct effect accounted for 50.80% (.159 / .313).

Table 4.14 Direct, indirect, and total effect of the mediation effect

Hypothesis	Effect	Path	β	SE	*p*	95% CI	
						Lower	Upper
H2c: *BI mediates the relationship between PBC and AB.*	Indirect	PBC->BI->AB	.154	.034	<.001	.088	.220
	Direct	PBC->AB	.159	.063	.011	.036	.283
	Total	PBC->AB	.313	.056	<.001	.203	.424
H3d: *PPHL mediates the relationship between AB and DPT.*	Indirect	AB->PPHL->DPT	.114	.021	<.001	.072	.156
	Direct	AB->DPT	.348	.047	<.001	.256	.439
	Total	AB->DPT	.462	.043	<.001	.377	.547

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

The standardized path coefficient for the indirect effect of AB -> PPHL -> DPT was .114 (95% CI [.072, .156], $p < .001$), indicating that PPHL mediated the relationship between AB and DPT. The standardized path coefficient for the direct effect of AB -> DPT was .348 (95% CI [.256, .439], $p < .001$), showing that PPHL had a partial mediation effect between AB and DPT. Therefore, hypothesis H3d, "*Perceived patient health literacy (PPHL) mediates the relationship between doctors' actual behavior of knowledge sharing (AB) and doctor-patient trust (DPT)*" was supported. Decomposing the mediation effect, we found that the mediation effect accounted for 24.68% of the total effect (.114 / .462), while the direct effect accounted for 75.32% of the total effect (.348 / .462).

We further tested the sequential mediation effect of the hypothesized model to evaluate the

mechanisms of multiple mediators between the independent and dependent variables. Based on the theoretical framework, we constructed a hypothesized model containing a sequential mediation process, where ATT, SN, and PBC are the independent variables, BI, AB, and PPHL are the mediators, and DPT is the dependent variable.

As shown in Table 4.15, the effect of ATT on AB was indirectly influenced by BI, with a standardized path coefficient of .122 (95% CI [.063, .180], $p < .001$). The effects of ATT on PPHL and DPT were both indirectly affected by BI and AB, with standardized path coefficients of .037 (95% CI [.017, .057], $p < .001$) and .042 (95% CI [.019, .065], $p < .001$), respectively. The effect of ATT on DPT was indirectly influenced by BI, AB, and PPHL, with a standardized path coefficient of .014 (95% CI [.006, .022], $p = .001$). Therefore, hypothesis H4a, "*Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between attitudes toward knowledge sharing (ATT) and doctor-patient trust (DPT)*", was supported.

Table 4.15 Mediation effect test of M0

Predictor	Mediator	Outcome	β	SE	β/SE	*p*	95% CI	
							Lower	Upper
ATT	BI	AB	.122	.030	4.071	<.001	.063	.180
SN	BI	AB	.145	.036	4.039	<.001	.075	.215
PBC	BI	AB	.154	.034	4.580	<.001	.088	.220
ATT	AB, BI	PPHL	.037	.010	3.671	<.001	.017	.057
SN	AB, BI	PPHL	.044	.013	3.416	.001	.019	.070
PBC	AB	PPHL	.049	.021	2.292	.022	.007	.091
PBC	AB, BI	PPHL	.047	.012	3.776	<.001	.023	.072
ATT	AB, BI	DPT	.042	.012	3.587	<.001	.019	.065
ATT	PPHL, AB, BI	DPT	.014	.004	3.325	.001	.006	.022
SN	AB, BI	DPT	.050	.014	3.575	<.001	.023	.078
SN	PPHL, AB, BI	DPT	.017	.005	3.070	.002	.006	.027
PBC	AB	DPT	.055	.025	2.245	.025	.007	.104
PBC	AB, BI	DPT	.054	.014	3.904	<.001	.027	.080
PBC	PPHL, AB	DPT	.018	.008	2.225	.026	.002	.034
PBC	PPHL, AB, BI	DPT	.018	.005	3.538	<.001	.008	.027

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

The effect of SN on AB was indirectly affected by BI, with a standardized path coefficient of .145 (95% CI [.075, .215], $p < .001$). The effects of SN on PPHL and DPT were both indirectly influenced by BI and AB, with standardized path coefficients of .044 (95% CI [.019, .070], $p = .001$) and .050 (95% CI [.023, .078], $p < .001$), respectively. The effect of SN on DPT was indirectly influenced by BI, AB, and PPHL, with a standardized path coefficient of .017 (95% CI [.006, .027], $p = .002$). Thus, hypothesis H4b, "*Doctors' behavioral intention*

to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between subjective norms for knowledge sharing (SN) and doctor-patient trust (DPT)", was supported.

The effect of PBC on AB was indirectly affected by BI, with a standardized path coefficient of .154 (95% CI [.088, .220], $p < .001$). The effects of PBC on PPHL and DPT were both indirectly influenced by BI and AB, with standardized path coefficients of .047 (95% CI [.023, .072], $p < .001$) and .054 (95% CI [.027, .080], $p < .001$), respectively. The effects of PBC on PPHL and DPT were both indirectly influenced by AB, with standardized path coefficients of .049 (95% CI [.007, .091], $p = .022$) and .055 (95% CI [.007, .104], $p = .025$). The effect of PBC on DPT was indirectly influenced by AB and PPHL, with a standardized path coefficient of .018 (95% CI [.002, .034], $p = .026$), and was also indirectly influenced by BI, AB, and PPHL, with a standardized path coefficient of .018 (95% CI [.008, .027], $p < .001$). Therefore, hypothesis H4c, "*Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between perceived behavioral control for knowledge sharing (PBC) and doctor-patient trust (DPT)*", was supported.

As shown in Table 4.16, when JE was introduced as a moderator, the direct effects of the hypothesized model remained significant. The interaction term between JE and BI (JE × BI) had a significant negative effect on AB, with a standardized path coefficient of -0.085 (95% CI [-0.155, -0.016], $p = 0.017$). The interaction term between JE and AB (JE × AB) had a significant negative effect on PPHL, with a standardized path coefficient of -0.089 (95% CI [-0.174, -0.004], $p = 0.041$).

Table 4.16 Moderation effect test of M0

Outcome	Predictor	β	SE	β/SE	*p*	95% CI	
						Lower	Upper
BI	ATT	.299	.040	7.459	<.001	.220	.377
BI	SN	.365	.045	8.135	<.001	.277	.454
BI	PBC	.169	.039	4.355	<.001	.093	.245
AB	BI	.488	.035	13.932	<.001	.420	.557
AB	PBC	.078	.040	1.969	.049	.000	.156
AB	JE	-.003	.037	-.072	.943	-.075	.070
AB	JE×BI	-.085	.036	-2.396	.017	-.155	-.016
PPHL	AB	.195	.046	4.217	<.001	.104	.285
PPHL	JE	-.117	.043	-2.743	.006	-.201	-.033
PPHL	JE×AB	-.089	.043	-2.047	.041	-.174	-.004
DPT	AB	.180	.045	3.996	<.001	.092	.269
DPT	PPHL	.377	.035	10.624	<.001	.308	.447

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

As shown in Figure 4.2, the correlations between the variables exhibit varying strengths and directions. These results provide valuable references and insights for subsequent analysis.

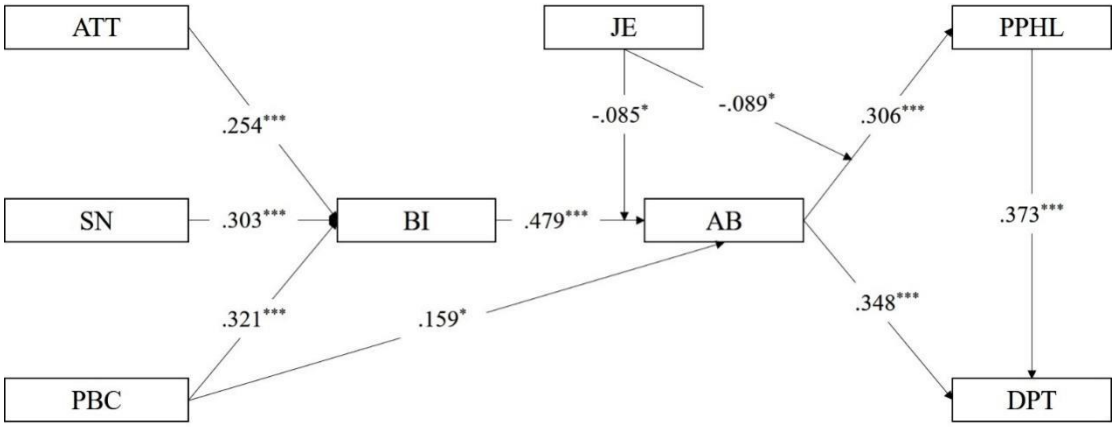

Figure 4.2 Path diagram of hypothesis model (M0)

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing; *p<.05; **p<.01; ***p<.001.

We further used slope graphs to illustrate the change in the relationship between BI and AB when JE was introduced as a moderator. As shown in Figure 4.3, under low levels of JE, there was a significant positive relationship between BI and AB. However, under high levels of JE, the absolute value of the slope decreased, indicating that the positive relationship between BI and AB was weakened. Thus, hypothesis H5a, "*Job effort (JE) weakens the relationship between doctors' behavioral intention to knowledge sharing (BI) and actual behavior of knowledge sharing (AB)*", was supported.

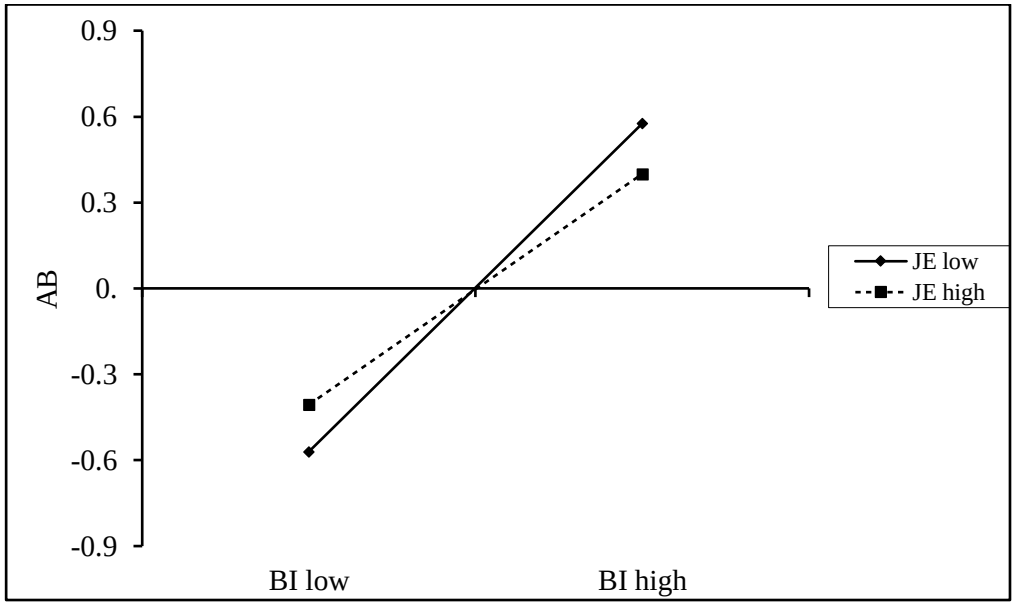

Figure 4.3 Interaction effect slope graph – change in the relationship between BI and AB with JE as a moderator

Note: AB = actual behavior of knowledge sharing; BI = behavioral intention to knowledge sharing; JE = job effort.

Then, we used a slope graph to reveal the change in the relationship between AB and PPHL when JE was included as a moderator. As shown in Figure 4.4, under low levels of JE, there was a significant positive relationship between AB and PPHL. However, under high levels of JE, the absolute value of the slope decreased, indicating that the positive relationship between AB and PPHL was weakened. Thus, hypothesis H5b, "*Job effort (JE) weakens the relationship between doctors' actual behavior of knowledge sharing (AB) and perceived patient health literacy (PPHL)*", was supported.

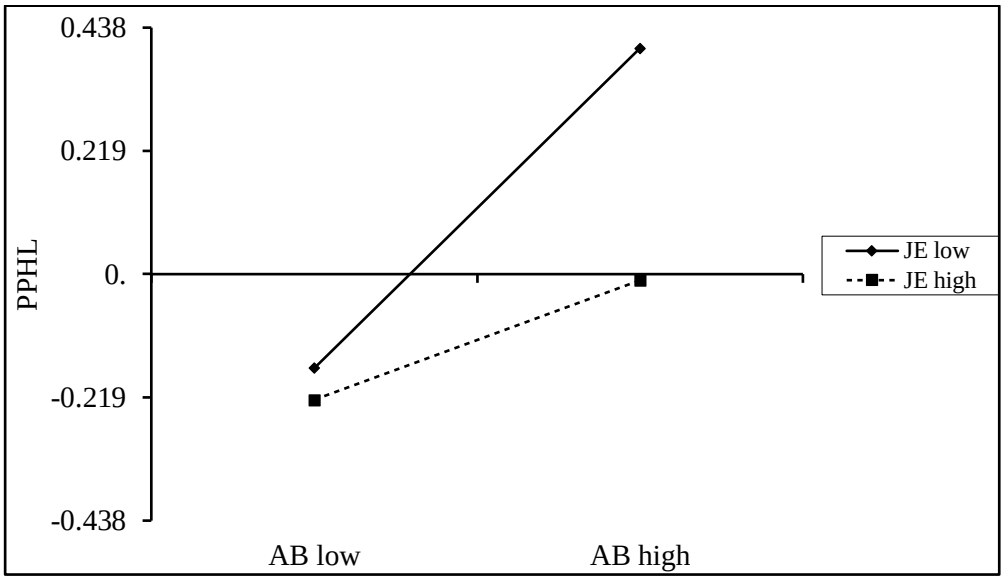

Figure 4.4 Interaction effect slope graph – change in the relationship between AB and PPHL with JE as a moderator

Note: AB = actual behavior of knowledge sharing; JE = job effort; PPHL = perceived patient health literacy.

4.6 Summary of hypothesis testing results

We conducted direct effect and mediation effect analyses on the theoretical model using Mplus, testing all the hypotheses proposed in this study. The results of the hypothesis testing are summarized in Table 4.17.

Table 4.17 Summary of hypothesis testing results

Code	Hypothesis	Result
H1a	*Doctors' attitudes toward knowledge sharing (ATT) are positively associated with their behavioral intention to knowledge sharing (BI).*	Supported
H1b	*Doctors' subjective norms for knowledge sharing (SN) are positively associated with their behavioral intention to knowledge sharing (BI).*	Supported
H1c	*Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with their behavioral intention to knowledge sharing (BI).*	Supported
H2a	*Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with the actual behavior of knowledge sharing (AB).*	Supported

Code	Hypothesis	Result
H2b	*Doctors' behavioral intention to knowledge sharing (BI) is positively associated with the actual behavior of knowledge sharing (AB).*	Supported
H2c	*Doctors' behavioral intention to knowledge sharing (BI) mediates the relationship between perceived behavioral control for knowledge sharing (PBC) and actual behavior of knowledge sharing (AB).*	Supported
H3a	*Doctors' actual behavior of knowledge sharing (AB) is positively associated with perceived patient health literacy (PPHL).*	Supported
H3b	*Doctors' actual behavior of knowledge sharing (AB) is positively associated with doctor-patient trust (DPT).*	Supported
H3c	*Perceived patient health literacy (PPHL) is positively associated with doctor-patient trust (DPT).*	Supported
H3d	*Perceived patient health literacy (PPHL) mediates the relationship between doctors' actual behavior of knowledge sharing (AB) and doctor-patient trust (DPT).*	Supported
H4a	*Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between attitudes toward knowledge sharing (ATT) and doctor-patient trust (DPT).*	Supported
H4b	*Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between subjective norms for knowledge sharing (SN) and doctor-patient trust (DPT).*	Supported
H4c	*Doctors' behavioral intention to knowledge sharing (BI), actual behavior of knowledge sharing (AB), and perceived patient health literacy (PPHL) sequentially mediate the relationship between perceived behavioral control for knowledge sharing (PBC) and doctor-patient trust (DPT).*	Supported
H5a	*Job effort (JE) weakens the relationship between doctors' behavioral intention to knowledge sharing (BI) and actual behavior of knowledge sharing (AB).*	Supported
H5b	*Job effort (JE) weakens the relationship between doctors' actual behavior of knowledge sharing (AB) and perceived patient health literacy (PPHL).*	Supported

Chapter 5: Discussion

This chapter concludes the findings of the study within the framework of the Theory of Planned Behavior (TPB). It compares the results with previous studies, explores possible reasons for the observations, and provides implications and recommendations for countermeasures and strategies.

5.1 Demographic characteristics of respondents

This study conducted an analysis of demographic characteristics of chronic disease doctors in order to gain a deeper understanding of this population's fundamental composition. The demographic profile revealed the diversity of the research sample across multiple dimensions, offering valuable data to explore the factors influencing doctors' knowledge-sharing behavior and its outcomes.

Specifically, female doctors slightly outnumbered male doctors in the sample. While this result is related to the sampling method, it also aligns with the reality that more women are engaged in the field of chronic disease management. Doctors of all age groups and tenure groups were represented in the study. This balanced distribution suggests that the research encompassed doctors' experiences and perspectives across different career stages. Regarding marital status, the vast majority of the respondents were married, which aligns with the distribution of age and tenure in the sample. In terms of education level, most of the respondents held a master's degree or above, which is in line with the high-level classification of the hospitals included in this study. The distribution of professional titles shows that attending physicians and associate chief physicians constituted a slightly higher proportion. They typically are the physicians who meet the minimum qualifications required for outpatient diagnostic and treatment responsibilities, although standards may vary across hospitals. In addition, attending physicians and associate chief physicians also constitute the main body of doctors in outpatient chronic disease management, and thus, their higher proportion reflects the reality. Furthermore, the outpatient volume indicates chronic disease doctors' workload and work intensity in their daily practice. The results showed that 42.5% of doctors attended to 31–70 patients per day. Moreover, patient follow-up is a prominent characteristic of chronic disease management. However, 31.6% of doctors reported a relatively low proportion of long-term

follow-up patients, possibly because the hospitals surveyed were not primary care institutions. The distribution of authorized beds and staffed beds in the sample shows that this study covered doctors from both small and large hospitals. Moreover, most doctors came from endocrinology, respiratory medicine, and cardiology departments, which are the most common chronic diseases.

5.2 Discussion of research variables

This study found that chronic disease doctors demonstrated high levels of attitudes toward knowledge sharing, subjective norms for knowledge sharing, perceived behavioral control for knowledge sharing, and behavioral intention to knowledge sharing. Their actual behavior of knowledge sharing, doctor-patient trust, and job effort showed a medium-high level, while perceived patient health literacy was at a medium level. These findings are crucial for understanding the facilitators and barriers influencing doctors' knowledge-sharing behavior.

5.2.1 Attitudes toward knowledge sharing

The results of this study indicated that doctors held a relatively positive attitude toward knowledge sharing. This is consistent with previous findings, such as those reported by Légaré et al. (2013) on doctors adopting interdisciplinary approaches to shared decision making, D. Wang et al. (2022) on shared decision making behaviors among Chinese doctors, and Lin et al. (2017) on the attitudes of healthcare professionals toward providing sexual health counseling services. Doctors' positive attitudes toward knowledge sharing observed in this study may be attributed to their professional responsibilities and the positive feedback and outcomes associated with knowledge sharing. Probably, the emphasis on patient education during doctors' medical training and professional development is conducive to shaping their positive attitudes toward sharing knowledge (Alissa & Alwargash, 2024). In addition, providing patients with health-related information and support can effectively encourage changes and maintenance in patients' health-related behaviors, thus preventing and reducing complications, mortality risks, and disease burdens associated with chronic illnesses (Anderson et al., 2017; Gao et al., 2022; Kärner et al., 2012). During the long-term follow-ups with chronic disease patients, doctors may perceive the positive impacts of knowledge sharing on promoting health, which further reinforces their supportive attitudes toward this behavior.

5.2.2 Subjective norms for knowledge sharing

This study revealed that doctors exhibited high levels of subjective norms for knowledge sharing, which is consistent with the findings of Légaré et al. (2013), who reported high levels of subjective norms in applying interdisciplinary approaches to shared decision making, but exceeds the levels reported by D. Wang et al. (2022) for shared decision making behaviors among Chinese doctors and the subjective norm levels revealed by Lin et al. (2017) regarding healthcare professionals providing sexual health counseling. The elevated subjective norms among chronic disease doctors may be related to patient expectations, peer expectations, and policy support. As patients increasingly demand active participation in managing their health, during interactions with doctors, they often expect to be informed about their health conditions and to have their questions answered (AlFaris et al., 2023). The second reason may lie in that chronic disease doctors widely acknowledge the benefits of enhancing patients' medical knowledge in terms of promoting behavior change, reducing health disparities, and influencing policy (Alissa & Alwargash, 2024). Moreover, policy initiatives such as the *Law of the People's Republic of China on Basic Medical and Health Care and the Promotion of Health* and the *Three-Year Action Plan to Further Raise Health Literacy for All Citizens (2024–2027)* emphasize "patient-centered" care and encourage doctors to improve patient health literacy, creating a supportive policy environment for knowledge sharing between doctors and patients.

5.2.3 Perceived behavioral control for knowledge sharing

The findings of this study revealed that doctors demonstrated a high level of perceived behavioral control for knowledge sharing, which aligns with the levels reported by Légaré et al. (2013) regarding adopting an interdisciplinary approach to shared decision making but surpasses those reported by D. Wang et al. (2022) regarding shared decision making among Chinese doctors and the perceived behavioral control levels found by Lin et al. (2017) concerning sexual health counseling among healthcare professionals. The elevated level of perceived behavioral control observed in this study indicates that chronic disease doctors feel a strong sense of autonomy and control in sharing knowledge with patients, which may be related to patients' positive feedback and doctors' self-efficacy. On one hand, chronic disease patients often need to establish long-term collaborative relationships with doctors and perform continuous self-management ((Kong et al., 2019; Yang, 2024). Positive feedback from patients, especially when they demonstrate understanding and acceptance of doctors' advice, can enhance doctors' sense of control in patient management. On the other hand, the repetitive and

systematic nature of chronic disease treatment and management (Bayen et al., 2024) enables chronic disease doctors to rapidly accumulate clinical experience and improve communication skills through repetitive and replicative treatment plants, thus boosting their self-efficacy in knowledge sharing.

5.2.4 Behavioral intention to knowledge sharing

This study also showed that doctors exhibited a high level of behavioral intention to knowledge sharing, which aligns with the findings of Légaré et al. (2013) regarding interdisciplinary shared decision making but surpasses the levels reported by D. Wang et al. (2022) and (Lin et al., 2017) regarding Chinese doctors' shared decision making and healthcare professionals' sexual health counseling, respectively. This high level of behavioral intention found in this study may be attributed to the positive feedback of knowledge sharing, societal expectations, and self-efficacy. Patients who access information and develop critical thinking skills are better equipped to manage chronic diseases (Simões et al., 2024). Doctors' recognition of the positive effect of knowledge sharing in chronic disease management is likely to enhance their behavioral intention to knowledge sharing. Moreover, chronic disease management requires adequate health literacy in order to meet long-term health demands (Rheault et al., 2021). Promoting health is a fundamental responsibility of healthcare professionals (Whitehead, 2011). Doctors' intention to knowledge sharing is shaped not only by patients' expectations and policy support but also by the consensus among their peers. Furthermore, sustaining patient adherence in chronic disease management necessitates continuous effort (Reach, 2023). Through regular treatment and continuous knowledge sharing, chronic disease doctors can quickly enhance their skills, thereby increasing their confidence and efficacy in performing knowledge sharing behavior.

5.2.5 Actual behavior of knowledge sharing

As mentioned previously, studies in the field of doctors' knowledge sharing mostly focus on the impact of various factors on behavioral intention rather than evaluating the effect of intention on actual behavior. While behavioral intention cannot always accurately predict actual behavior (Gollwitzer, 1999; Perkins et al., 2007), many studies have confirmed a strong relationship between the two (Gao et al., 2008; Kim & Lee, 2023). This study showed that doctors' actual behavior of knowledge sharing was at a medium-high level, indicating relatively frequent actual behavior of knowledge sharing between chronic disease doctors and their

patients. This actual behavior is a result of multiple factors. The long-term and complex nature of chronic disease management necessitates the establishment of a stable and frequent communication mechanism between doctors and patients. In this context, positive health outcomes among long-term follow-up patients can boost doctors' confidence in knowledge sharing. Additionally, government policy support and the transition of modern healthcare modes toward "patient-centered" care have created favorable conditions for knowledge sharing between doctors and patients. As patients increasingly seek to understand their health conditions, doctors are required to share more knowledge with patients to meet their demands. Over time, as doctors engage in long-term patient follow-ups and the healthcare evolves into a patient-centered mode, doctors' communication skills continue to improve, further enhancing the frequency and effectiveness of their knowledge sharing. However, the mean score of the actual behavior of knowledge sharing was slightly lower than that of behavioral intention, suggesting the translation of intention into actual behavior may be hindered by certain barriers.

5.2.6 Perceived patient health literacy

The findings revealed that perceived patient health literacy was at a medium level. This indicates that, during long-term follow-ups, particularly after doctors share medical knowledge, they perceive that patients possess a certain degree of health literacy, although there remains room for improvement. Currently in China, the number of individuals who possess basic health knowledge and skills may still be relatively low. The information asymmetry between patients and doctors is an inherent characteristic of the doctor-patient relationship (Zhao et al., 2016). A medium level of perceived patient health literacy suggests a potential gap between the medical knowledge shared by doctors and the actual knowledge understood and acquired by patients. This gap is especially pronounced among elderly patients, the main demographic for chronic diseases, who face greater challenges in understanding medical knowledge. This gap can exacerbate misunderstandings of treatment plans and potentially undermine doctor-patient trust. Therefore, doctors need to accurately identify the health literacy characteristics of this population and enhance medical knowledge sharing to bridge the divide and promote trust.

5.2.7 Doctor-patient trust

In this study, we measured doctor-patient trust by employing the doctor-patient trust dimension of the scale of Doctor-Patient Relationship in China (DRP-C) developed by Zeng et al. (2022); Zeng et al. (2023). This is currently the only scale specifically designed to measure Chinese

doctors' perceptions of patients' trust in them. The results of our study showed that doctor-patient trust was at a medium-high level, consistent with the findings reported by Zeng (2018). In recent years, China's healthcare system reform has yielded commendable results, including the expanded coverage of public health insurance, reform in public hospitals, and strengthened primary healthcare infrastructure (Li & Fu, 2017; Tao et al., 2020). Patient satisfaction has been incorporated into the performance appraisal metrics for public hospitals in China (Yuanyuan Li et al., 2022). Additionally, the prevention and resolution mechanisms for medical disputes have improved, protecting the legal rights of both doctors and patients (Ma et al., 2021; X. Zhang et al., 2021). However, while macro-level policies have created favorable conditions for doctor-patient relationships, the communication between doctors and patients remains one of the most critical factors influencing doctor-patient trust during medical consultations (Liu et al., 2024; Petrocchi et al., 2019). In the follow-ups for chronic disease management, doctor-patient trust typically develops gradually and progresses in a layered, incremental manner.

5.2.8 Job effort

The results showed that doctors' job effort was at a medium-high level, which aligns with the findings reported for healthcare professionals in emergency hospitals in Germany (Schneider et al., 2023) but is slightly higher than the levels reported by Li et al. (2006) for Chinese inpatient ward doctors, Lee et al. (2014) for US intensive care unit nurses, and Wang et al. (2014) for Chinese doctors, and also exceeds the findings from a meta-analysis of 41 studies conducted by Le Huu et al. (2022). The level of job stress among doctors varies across countries, healthcare systems, and specific occupational groups. In China, the increasing prevalence of chronic diseases, driven by an aging population and lifestyle changes, has imposed a significant workload on chronic disease doctors (Chen et al., 2022). Additionally, chronic disease doctors, like most other doctors in China, are burdened with substantial research and learning tasks for their career development (Emery & Gregory, 2006; Tian et al., 2020). Furthermore, the chronic disease doctors surveyed in this study all had qualifications for outpatient consultation. Typically, these doctors are responsible not only for outpatient consultations and diagnoses but also for the monitoring and treatment of inpatients in wards.

5.3 Discussion on the results of differences analysis

Older doctors tend to exhibit a more positive attitude toward knowledge sharing. Compared to non-chronic diseases, managing chronic disease patients requires doctors to take on more

complex and burdensome tasks (Moth et al., 2012). Older doctors may be more skilled at making quick decisions, enabling them to spare more time for knowledge sharing. In addition, younger doctors with shorter tenure are likely to have less clinical experience and communication skills. Patients sometimes may struggle to clearly convey their concerns to doctors (Sari et al., 2016). In handling patients with low health literacy, younger doctors may be less competent. Moreover, in China, younger doctors tend to experience higher rates of job burnout (Lo et al., 2018), which can hinder their ability to express and communicate effectively. Furthermore, in traditional Chinese culture, older doctors are often perceived as a mature and reliable professional group. Middle-aged doctors in mid-stage careers typically bear more responsibilities, such as teaching and research. Stressful work environments with limited resources or autonomy can negatively impact their work engagement (W. Lu et al., 2023).

Doctors working in smaller hospitals tend to perceive higher subjective norms for knowledge sharing. Smaller hospitals may be more eager to attract more patients by providing high-quality services, such as encouraging knowledge sharing. In cases of patients with multimorbidity, doctors may expect to share knowledge thoroughly and mutually with patients so as to enhance their health management capabilities. Conversely, doctors in larger hospitals exhibit lower behavioral intention to knowledge sharing and lower actual behavior of knowledge sharing, accompanied by higher job effort. However, compared to hospital size, outpatient volume may have a more direct impact on doctors' knowledge sharing behaviors. Doctors with higher outpatient volumes tend to exhibit lower levels of actual behavior of knowledge sharing. In China, many patients with common, mild, or chronic illnesses prefer to visit large hospitals. Under the pressure of high patient volumes, doctors in these hospitals often prioritize finishing each consultation in a short time (Liu et al., 2019). In this case, knowledge sharing may not be the doctors' priority. Additionally, doctors in larger hospitals are more likely to encounter interruptions, which can further increase their workload (Motsohi et al., 2024).

Resident physicians reported lower perceived behavioral control for knowledge sharing. Hierarchical status can act as a barrier to knowledge sharing (Jabr, 2007). Doctors with higher professional titles often have more autonomy when performing medical practices, including knowledge sharing. In contrast, resident physicians may lack confidence in understanding patients' needs and explaining medical terms due to insufficient professional competence and communication skills. Moreover, doctors with higher professional titles tend to perceive higher levels of doctor-patient trust from long-term follow-up patients. Chronic disease patients tend to trust doctors with advanced professional techniques and expertise (Isangula et al., 2020). Hence, doctors with higher professional titles are more likely to gain patients' trust due to their

extensive professional experiences. Furthermore, health literacy is a predictor of successful self-management for chronic disease patients (Heijmans et al., 2015). With superior professional capabilities, doctors with higher professional titles can more effectively help patients achieve their health management goals, thereby strengthening the patients' trust.

Doctors with a higher proportion of long-term follow-up patients demonstrated higher levels of actual behavior of knowledge sharing. Over time, follow-up patients may develop greater expectations and demands for disease management (Sandelowsky et al., 2023). Besides, doctors who maintain ongoing contact with patients do not need to refamiliarize themselves with patients' medical conditions at every visit (Hudon et al., 2011; Sells et al., 2009). In such cases, doctors may have more time to provide detailed medical knowledge to patients. Moreover, chronic disease doctors with fewer long-term follow-up patients exhibited lower levels of doctor-patient trust. A sustained doctor-patient relationship is conducive to the establishment of doctor-patient trust (Tarrant et al., 2010; Wright & Mainous III, 2018). Doctors who provide long-term medical services to patients are more able to understand patients' needs (Damarell et al., 2020), which fosters stronger doctor-patient relationships with trust.

Furthermore, female doctors showed higher behavioral intention to knowledge sharing compared to male doctors. During doctor-patient interactions, female doctors often demonstrate a stronger sense of responsibility toward the vulnerable party – patients (Hall & Roter, 1998) and are more inclined to address patients' psychological and social needs (Zhang et al., 2024). Besides, compared to male doctors, female doctors tend to exhibit greater empathy and patience, as well as superior communication skills (Guo & Wang, 2021). These qualities provide female doctors with advantageous conditions for engaging in knowledge sharing.

5.4 Discussion on the relationships between variables

This study confirmed the applicability of TPB in explaining the knowledge sharing behavior of chronic disease doctors. It also revealed the relationships among the actual behavior of knowledge sharing, perceived patient health literacy, and doctor-patient trust. The knowledge sharing behavior of chronic disease doctors, whether in real-time communication during consultations or over long-term follow-ups, is conducive to enhancing patient health literacy and establishing trust-based relationships.

5.4.1 Doctors' attitudes toward knowledge sharing and behavioral intention

Doctors' attitudes toward knowledge sharing were significantly positively associated with

behavioral intention to knowledge sharing (β = .237, $p < .01$), indicating that a positive attitude toward knowledge sharing will enhance the intention to engage in such behavior. This finding is consistent with the results of Millstein (1996), Van Rijssen et al. (2011), and Lin et al. (2017). According to TPB, attitudes are one of the key determinants of behavioral intention (Ajzen, 2020; Bosnjak et al., 2020). On one hand, doctors, as pragmatic decision-makers, often resist changes they perceive as non-beneficial to their medical practice or professional development (Freidson, 2001). When consultation time is limited, chronic disease doctors' perception of the importance of knowledge sharing can determine whether this task should be retained. On the other hand, doctors who actively share medical knowledge may receive more positive feedback from patients, such as enhanced reputation, increased patient satisfaction, or improved treatment adherence. This positive feedback loop will encourage doctors to continue sharing knowledge in future consultations (Lin, 2007). Given that, hypothesis H1a, "*Doctors' attitudes toward knowledge sharing (ATT) are positively associated with their behavioral intention to knowledge sharing (BI)*", is supported. Therefore, incentive systems should be designed to reward doctors who allocate sufficient time to knowledge sharing and actively engage in knowledge sharing with their patients.

5.4.2 Doctors' subjective norms for knowledge sharing and behavioral intention

Doctors' subjective norms for knowledge sharing were significantly positively associated with behavioral intention to knowledge sharing (β = .285, $p < .01$). This indicates that chronic disease doctors are more likely to demonstrate the intention to share knowledge when they perceive stronger social expectations and professional recognition. This finding is consistent with the findings of Millstein (1996) and Lin et al. (2017) but differs from the results of Van Rijssen et al. (2011). The inconsistency may be due to differences in the professional backgrounds of the doctors studied. According to TPB, subjective norms are a core determinant of behavioral intention (Ajzen, 2020; Bosnjak et al., 2020). The public increasingly expects healthcare practitioners not only to treat diseases but also to promote healthy lifestyles (Calderón et al., 2011; Margalit et al., 2009; Scaffa et al., 2008). For chronic disease doctors, sharing medical knowledge with patients is a key element in fulfilling this expectation. Additionally, in the treatment of comorbid chronic diseases, doctors often expect one another to jointly and actively engage in the overall management of diseases, where knowledge sharing is critical to an effective collaboration. Peer recognition and praise gained through knowledge sharing not only provide immediate positive feedback but can also reinforce behavioral intention through role modeling (Wang et al., 2014). Moreover, at the organizational level, policymakers and

administrators can foster a culture of knowledge sharing through their influential roles (Sparrowe et al., 2001). This organizational culture will encourage doctors to be more willing to share knowledge. Hence, hypothesis H1b, "*Doctors' subjective norms for knowledge sharing (SN) are positively associated with their behavioral intention to knowledge sharing (BI)*", is supported. Therefore, it is essential to create an environment that supports knowledge sharing.

5.4.3 Doctors' perceived behavioral control for knowledge sharing and behavioral intention

Doctors' perceived behavioral control for knowledge sharing was significantly positively associated with behavioral intention to knowledge sharing ($\beta = .353$, $p < .01$). This indicates that higher perceived behavioral control can increase the likelihood of doctors engaging in knowledge sharing. The result aligns with the findings of Millstein (1996), Van Rijssen et al. (2011), and Lin et al. (2017). According to TPB, behavioral intention is influenced by perceived behavioral control (Ajzen, 2020; Bosnjak et al., 2020). For chronic disease doctors, perceived behavioral control may be related to their professional competence, communication skills, and time management capabilities (Jabr, 2007). Studies have shown that a doctor's mastery of professional knowledge is a key factor in effective communication (Quinn et al., 2008). Hence, doctors' professional competence may directly influence their intention to engage in knowledge sharing. Moreover, for chronic disease doctors, sharing knowledge alone is insufficient. The key lies in how effectively they can convey this knowledge to patients through good communication skills during consultations (Makoul & Curry, 2007; Tamblyn et al., 2007). In addition, doctors' belief in their control over knowledge sharing may also stem from their awareness and evaluation of external conditions and resources (Millstein, 1996). When doctors perceive that they have inadequate time management skills, their intention to share knowledge may decrease. Furthermore, doctors' inadequate professional competence and communication skills could exacerbate their perception of time pressure. Hence, Hypothesis H1c, "*Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with their behavioral intention to knowledge sharing (BI)*", is supported. Therefore, in addition to enhancing professional competence, improving doctors' communication and time management skills should also be prioritized.

5.4.4 Doctors' perceived behavioral control for knowledge sharing and actual behavior

Doctors' perceived behavioral control for knowledge sharing was significantly positively

associated with the actual behavior of knowledge sharing (β = .185, p = .009), indicating that increased perceived behavioral control could enhance the frequency of the actual behavior of knowledge sharing. This finding is consistent with the results of Millstein (1996) and Ashby et al. (2012). According to TPB, perceived behavioral control is a core determinant of both behavioral intention and actual behavior (Ajzen, 2020; Bosnjak et al., 2020). Doctors who believe they can control the process of patient education, are confident in their ability to perform the behavior, and perceive the behavior as manageable tend to have stronger intention to educate patients and are more likely to perform this behavior frequently (Millstein, 1996). Furthermore, research has confirmed that healthcare practitioners' behavior of providing healthy lifestyle advice is related to whether they have the latest guidelines or evidences (Ashby et al., 2012). Professional competence is one of the key factors enabling doctors to perform high-quality knowledge sharing practices. In addition, doctors' belief in their control over the knowledge sharing process not only stems from their intrinsic self-efficacy but also from a realistic assessment of external environmental factors (Millstein, 1996). These factors include but are not limited to policies, work environments, and social support. Hence, hypothesis H2a, "*Doctors' perceived behavioral control for knowledge sharing (PBC) is positively associated with the actual behavior of knowledge sharing (AB)*", is supported. Therefore, strategies to improve doctors' competence should be patient-centered, comprehensive, and systematic.

5.4.5 Doctors' behavioral intention to knowledge sharing and actual behavior

Doctors' behavioral intention to knowledge sharing was significantly positively associated with the actual behavior of knowledge sharing (β = .457, p < .001), demonstrating that stronger behavioral intention can increase the frequency of the actual knowledge sharing behavior. This finding is similar to those of Millstein (1996) and Lin et al. (2017). According to TPB, behavioral intention directly influences the frequency of actual behavior (Ajzen, 2020; Bosnjak et al., 2020). As a mediator, behavioral intention highlights doctors' internal motivation and decision making processes when determining whether to engage in knowledge sharing. When evaluating their ability to successfully perform the knowledge sharing behavior, doctors not only consider their perceived control over the process but also account for potential barriers. In this study, apart from perceived behavioral control, behavioral intention, as a bridge connecting personal attitudes, subjective norms, and actual behavior, partially explains why some doctors are inclined to share medical knowledge with patients while others remain more conservative. In summary, the results support hypothesis H2b, "*Doctors' behavioral intention to knowledge sharing (BI) is positively associated with the actual behavior of knowledge sharing (AB)*".

Therefore, addressing the barriers that hinder the translation of doctors' behavioral intention into the actual behavior of knowledge sharing holds significant practical value.

5.4.6 Doctors' actual behavior of knowledge sharing and perceived patient health literacy

Doctors' actual behavior of knowledge sharing was significantly positively associated with perceived patient health literacy ($\beta = .306$, $p < .001$), indicating that more frequent knowledge sharing by doctors leads to higher perceived patient health literacy. This finding is consistent with the results of Hemming and Langille (2006) and C. Li et al. (2022). Actual behavior is an essential component of TPB. Its occurrence and frequency directly reflect the attention and effort that chronic disease doctors place on sharing medical knowledge. On one hand, knowledge sharing is typically accompanied by bidirectional interaction between doctors and patients (Vainauskienė & Vaitkienė, 2022). Doctors' behavior of knowledge sharing not only can improve patient health literacy (Meng et al., 2024) but also enhances doctors' communication efficiency (Lee et al., 2019), enabling them to more accurately identify and assess patient health literacy levels (Storms et al., 2019; Yang, 2022). On the other hand, enhancing health awareness is one of the most effective ways to motivate individuals to adopt healthy lifestyles (Alissa & Alwargash, 2024). By regularly following up with patients and observing how well they manage their health using the shared knowledge, chronic disease doctors can clearly perceive the improvements in patient health literacy. According to the above discussion, Hypothesis H3a, "*Doctors' actual behavior of knowledge sharing (AB) is positively associated with perceived patient health literacy (PPHL)*", is supported. Therefore, during the knowledge sharing process, health literacy assessment tools could be used in combination with interactive educational aids (e.g., virtual reality and artificial intelligence).

5.4.7 Doctors' actual behavior of knowledge sharing and doctor-patient trust

Doctors' actual behavior of knowledge sharing was significantly positively associated with doctor-patient trust ($\beta = .348$, $p < .001$). This indicates that the more frequently doctors share knowledge, the stronger they perceive patients' trust in them. This result aligns with the findings of AlRuthia et al. (2019) and Sayed Ahmed et al. (2024). Research has shown that doctors' exploration of patients' disease experiences during consultations is independently positively associated with patients' trust in doctors (Fiscella et al., 2004). The outcomes of doctors' exploration of patients' diseases need to be disseminated and applied through knowledge

sharing so as to realize their value. Thus, chronic disease doctors' actual behavior of knowledge sharing may enhance patients' recognition of doctors' professional competence, contributing to trust establishment with long-term follow-up patients. Moreover, effective communication not only can improve the self-management ability of chronic disease patients (Sandelowsky et al., 2023) but also enhances their health outcomes and quality of life (Epstein et al., 2010; Stewart, 1995). When patients actively engage in health management by following medical advice and improve their health status, it can positively influence the mutual trust between doctors and patients. Thus, hypothesis H3b, "*Doctors' actual behavior of knowledge sharing (AB) is positively associated with doctor-patient trust (DPT)*", is supported. Therefore, strategies that encourage doctors to share knowledge not only can improve the doctor-patient relationship during consultations but also contribute positively to patients' long-term health.

5.4.8 Perceived patient health literacy and doctor-patient trust

Perceived patient health literacy was significantly positively associated with doctor-patient trust ($\beta = .372$, $p < .001$). This indicates that when doctors perceive patient's higher health literacy, they also perceive stronger doctor-patient trust. This finding is consistent with the results reported by Chandra and Mohammadnezhad (2020) and Tiwari et al. (2023). On one hand, patients with higher health literacy are better able to articulate their needs and concerns and can better understand the treatment plans and doctors' instructions, thus ensuring a greater consensus between doctors and patients. The alignment of patients' opinions with the doctors' on health-related information can significantly enhance patients' trust in doctors (Liu et al., 2024). On the other hand, health literacy is a fundamental element for empowering patients, increasing their participation, and activating their engagement. Acquiring more medical knowledge enables patients to better self-manage their health and take appropriate actions to improve their health status (Ma et al., 2022). As patients' health gradually improves, their trust in doctors also strengthens (Bryant et al., 2012). Given these, Hypothesis H3c, "*Perceived patient health literacy (PPHL) is positively associated with doctor-patient trust (DPT)*", is supported. Therefore, to further foster doctor-patient trust, the evaluation of long-term follow-up patients' health literacy could be considered as an indicator of the effectiveness of doctors' knowledge sharing practices.

5.5 Discussion on mediation effects

Although doctors may have a strong behavioral intention to share knowledge, this intention

does not always translate into the actual behavior of knowledge sharing. In medical contexts, doctors may face various constraints that limit their ability to fully control their knowledge sharing behavior. Furthermore, using the TPB framework to promote doctors' knowledge sharing behavior may not only lead to enhanced patient health literacy but can also improve doctor-patient trust by fostering improved health outcomes.

5.5.1 Mediation of behavioral intention to knowledge sharing between perceived behavioral control and actual behavior

The standardized path coefficient for the indirect effect of perceived behavioral control -> behavioral intention -> actual behavior of knowledge sharing was .161 ($p < .001$). Decomposing the mediation effect, we found that the mediation accounted for 46.53% of the total effect. This indicates that behavioral intention to knowledge sharing partially mediated the relationship between perceived behavioral control and the actual behavior of knowledge sharing. Within the TPB framework, although behavioral intention is an antecedent to actual behavior, it is not the sole determinant: perceived behavioral control also has a significant direct effect on actual behavior (Javadi et al., 2013). Only when the conditions for actual control are sufficiently met can behavioral intention directly determine the occurrence of actual behavior (Bosnjak et al., 2020). As such, doctors' behavioral intention to knowledge sharing cannot always be translated into actual behavior. In this process, perceived behavioral control also plays a crucial role.

Furthermore, the results of this study showed that the direct effect of doctors' perceived behavioral control for knowledge sharing on actual behavior ($\beta = .185$) was greater than the mediation effect of behavioral intention ($\beta = .161$) in this process. When doctors perceive that performing the behavior exceeds their control capacity, even if they have a strong behavioral intention, it may not lead to actual behavior. In real-world clinical scenarios, doctors may be constrained by various factors, such as time, resources, and environments. Hence, hypothesis H2c, "*Doctors' behavioral intention to knowledge sharing (BI) mediates the relationship between perceived behavioral control for knowledge sharing (PBC) and actual behavior of knowledge sharing (AB)*", is supported. Therefore, it is crucial to create a supportive organizational environment for doctors to engage in knowledge sharing.

5.5.2 Mediation of perceived patient health literacy between actual behavior of knowledge sharing and doctor-patient trust

The standardized path coefficient for the indirect effect of actual behavior of knowledge sharing

-> perceived patient health literacy -> doctor-patient trust was .114 ($p < .001$). Decomposing the mediation effect, we found that the mediation effect accounted for 24.68% of the total effect. This finding indicates that perceived patient health literacy partially mediated the relationship between doctors' actual behavior of knowledge sharing and doctor-patient trust. When doctors provide adequate, personalized, and comprehensive information and encourage patients to actively learn about their diseases, it can enhance patients' self-management abilities (Sandelowsky et al., 2023). From the patients' perspective, if doctors proactively deliver information and motivate them to learn, it will improve their ability to understand and apply the health knowledge, thereby leading to positive health outcomes. Therefore, more frequent knowledge sharing behavior by doctors is likely to result in higher perceived patient health literacy. Moreover, in medical practice, doctors' knowledge sharing behavior can reduce trust barriers caused by information asymmetry between doctors and patients (Ma et al., 2022). Patients with higher levels of health literacy tend to show greater trust in doctors (Tsai et al., 2018). Therefore, improving patient health literacy is a critical step in enhancing the positive impact of doctors' knowledge sharing behavior on doctor-patient trust.

In addition, this study also showed that the direct effect of doctors' actual behavior of knowledge sharing on doctor-patient trust exceeded the mediation effect of perceived patient health literacy in this process. On one hand, doctors' knowledge sharing behavior is not merely a matter of transmitting medical knowledge or promoting patient health literacy; through knowledge sharing, doctors can demonstrate their professional competence to patients (Ma et al., 2022). Patients will assess doctors' professional competence and service quality based on the medical information shared by the doctors (Liu et al., 2024). Such recognition of doctors' expertise can directly influence patients' trust in doctors. On the other hand, the knowledge sharing behavior itself conveys doctors' care and respect for their patients, making them feel being valued, thus fostering the establishment of trust. Given these, Hypothesis H3d, "*Perceived patient health literacy (PPHL) mediates the relationship between doctors' actual behavior of knowledge sharing (AB) and doctor-patient trust (DPT)*", is supported. Therefore, doctors' knowledge sharing behavior essentially embodies a patient-centered care philosophy.

5.5.3 Sequential mediation of behavioral intention to knowledge sharing, actual behavior, and perceived patient health literacy in the relationship of attitudes, subjective norms, and perceived behavioral control with doctor-patient trust

The influence of attitudes toward knowledge sharing on doctor-patient trust was mediated by behavioral intention to knowledge sharing, actual behavior of knowledge sharing, and

perceived patient health literacy, with a standardized path coefficient of .012 (p = .003). Similarly, the effect of subjective norms for knowledge sharing on doctor-patient trust was mediated by the same variables, with a standardized path coefficient of .015 (p = .001). Moreover, the impact of perceived behavioral control for knowledge sharing on doctor-patient trust was mediated by these three variables, with a standardized path coefficient of .018 (p < .001).

Within the TPB framework, attitudes, subjective norms, and perceived behavioral control are all predictors of behavioral intention (Afshar Jalili & Ghaleh, 2021), and behavioral intention is the direct antecedent of actual behavior (Ajzen, 2020). When doctors actively share medical knowledge with patients, they are not only transmitting essential information about disease management and health promotion but also helping patients better understand their health conditions and take appropriate actions to manage their health (Bryant et al., 2012). In the medical process, patients' active engagement can help to deepen the emotional connection between doctors and patients (He et al., 2022). Hence, chronic disease doctors' attitudes toward knowledge sharing, subjective norms for knowledge sharing, and perceived behavioral control will affect doctor-patient trust by influencing the behavioral intention to knowledge sharing, actual behavior of knowledge sharing, and perceived patient health literacy. Given the above discussion, hypotheses H4a, H4b, and H4c (i.e., behavioral intention to knowledge sharing, actual behavior of knowledge sharing, and perceived patient health literacy sequentially mediate the relationships of attitudes toward knowledge sharing, subjective norms for knowledge sharing, and perceived behavioral control for knowledge sharing with doctor-patient trust) are all supported. Therefore, promoting doctors' knowledge sharing behavior through a comprehensive TPB-based strategy is a beneficial attempt to enhance patient health literacy and improve doctor-patient trust.

5.6 Discussion on moderation effects

In China, chronic disease doctors often face numerous challenges, including high-intensity workloads, frequent work interruptions, and job burnout, which may negatively affect doctors' ability to engage in knowledge sharing and reduce the actual effectiveness of the knowledge sharing practice.

5.6.1 Moderation of job effort on the relationship between behavioral intention to knowledge sharing and actual behavior

The interaction between job effort and behavioral intention to knowledge sharing (JE × BI) significantly negatively affected the actual behavior of knowledge sharing, with a standardized path coefficient of -0.085 (p = 0.014). This indicates that job effort weakened the relationship between behavioral intention to knowledge sharing and the actual behavior. On average, Chinese doctors work over 10 hours per day (Hu et al., 2016). Under time pressures, doctors may reduce their conversations with patients (Freedman et al., 2021). To meet more urgent clinical demands, doctors may not prioritize knowledge sharing. Additionally, research has shown that doctors are interrupted approximately one to four times during each consultation (Motsohi et al., 2024; Peleg et al., 2000). These interruptions, either other-patients-related or non-clinical, will disrupt the continuity of the medical process (Rivera-Rodriguez & Karsh, 2010). They can also compromise the coherence and comprehensiveness of doctors' knowledge sharing practice. Furthermore, Chinese doctors' high job effort is not adequately compensated (S. Zhang et al., 2020), potentially leading to avoidance or delay of their knowledge sharing behaviors. Hence, hypothesis H5a, "*Job effort (JE) weakens the relationship between doctors' behavioral intention to knowledge sharing (BI) and actual behavior of knowledge sharing (AB)*", is supported. Therefore, to support doctors in knowledge sharing, strategies should be implemented to address specific environmental factors, such as workload and unnecessary interruptions during medical process.

5.6.2 Moderation of job effort on the relationship between actual behavior of knowledge sharing and perceived patient health literacy

The interaction between job effort and actual behavior of knowledge sharing (JE × AB) significantly negatively affected perceived patient health literacy, with a standardized path coefficient of -0.089 (p = 0.023). This suggests that job effort weakened the relationship between actual behavior of knowledge sharing and perceived patient health literacy. Short consultation times may lead doctors to interrupt patients before they have fully expressed themselves (Rhoades et al., 2001) and restrict the comprehensive assessment and management of patients' concerns (Linzer et al., 2015). In such cases, even if doctors' knowledge sharing behavior is relatively frequent, there may not be sufficient time for them to thoroughly evaluate changes in patient health literacy. Moreover, the prolonged heavy workload often leads to fatigue among Chinese doctors (Wu et al., 2013). In a fatigued state, doctors may fail to

accurately assess patient health literacy or may overlook any improvement, even if they have engaged in knowledge sharing. Additionally, verbal distractions, door knocks, pager alerts, and computer use can all disturb doctor-patient communication (Rhoades et al., 2001). Such disturbances may impede doctors' focus, limiting their ability to attend closely to the enhancement of patient health literacy. Given the above discussion, hypothesis H5b, "*Job effort (JE) weakens the relationship between doctors' actual behavior of knowledge sharing (AB) and perceived patient health literacy (PPHL)*", is supported. Therefore, simple health literacy assessment tools could be integrated into clinical decision support systems to help evaluate the outcomes of doctors' knowledge sharing behaviors.

Chapter 6: Conclusions

This chapter presents the practical implications and theoretical contributions of this research. It will also point out the limitations and propose future research directions. Finally, it summarizes the findings and draws conclusions.

6.1 Managerial implications

This study confirmed the applicability of the Theory of Planned Behavior (TPB) in understanding chronic disease doctors' knowledge sharing behavior and revealed how actual behavior of knowledge sharing influences perceived patient health literacy and doctor-patient trust. Additionally, this study explored how job effort impacts the knowledge sharing process. Governments and hospitals should implement measures to form a positive feedback loop for fostering doctors' knowledge sharing behavior. Besides, doctors and patients should collaborate in chronic disease management and continue to strengthen mutual trust.

6.1.1 Policymaking

Chronic disease doctors play a vital role in diagnosing and treating diseases as well as guiding patients in health management. They are not only key decision-makers in treatment plans but also authoritative disseminators of medical knowledge. To effectively encourage doctors to share knowledge with patients, health authorities should establish appraisal methods and reward systems related to knowledge sharing to evaluate doctors' knowledge sharing behavior and reward the positive outcomes.

In the information age, the abundance of information make it difficult for the public to distinguish true and false information, forcing doctors to spend additional time and effort in correcting patients' misconceptions. To tackle this problem, health authorities should collaborate with internet regulatory bodies to jointly crack down on false health information on the internet and strengthen the dissemination of scientific knowledge, so as to reduce information conflicts between doctors and patients and the time waster in knowledge sharing.

Chinese doctors, particularly chronic disease doctors in large hospitals, generally face heavy workloads. Health authorities should optimize resource allocation and adjust medical

insurance policies to encourage patients with chronic diseases to seek care at primary healthcare institutions rather than large hospitals, thus realizing reasonable workload allocation across hospitals on a macro level. Besides, they should minimize unnecessary administrative tasks on doctors and improve doctors' salaries and benefits to ensure doctors have sufficient time and enthusiasm for high-quality knowledge sharing.

6.1.2 Hospital management

Hospital management should prioritize reducing doctors' workload or job burden to ensure they have sufficient time and energy to share medical knowledge with patients. To mitigate the potential weakening effect of job effort on knowledge sharing, hospital management should use modern information technologies, such as teleconsultation platforms, internet hospitals, and smart queuing systems, to continuously optimize medical processes for chronic disease patients, ensuring there is sufficient time for every patient to receive knowledge from doctors. Moreover, hospital management can provide advanced clinical decision support systems to improve the efficiency of doctors' diagnostic and treatment decision making, allowing more time for knowledge sharing. In addition, to ensure the continuity and coherence of doctors' knowledge sharing practice, hospital management should minimize non-clinical tasks on doctors.

To incentivize doctors to engage in knowledge sharing, hospital management should establish and improve the incentive mechanism, incorporating knowledge sharing performance as a key indicator in the appraisal system for doctors' promotion and academic assessments. To enhance doctors' awareness of the importance of knowledge sharing, hospital management should make efforts to foster a culture that encourages knowledge sharing. Moreover, to reduce doctors' barriers in the knowledge sharing process, hospital management should prioritize training programs to improve doctors' professional competence and communication skills. They should also offer necessary technical support, such as building user-friendly knowledge sharing platforms, to improve knowledge sharing efficiency. In addition, to balance doctors' clinical responsibilities with their knowledge sharing, hospital management should optimize doctors' work schedules and task allocations to ensure that they have sufficient time to share medical knowledge despite busy clinical work.

The characteristics of chronic disease patients may vary across hospitals due to regional differences, hospital scale, service capacity, and patient demographics. Therefore, hospital management can consider developing or introducing simple health literacy assessment tools to enable doctors to quickly and accurately assess patients' health literacy levels and health needs. These tools can be complemented by interactive educational aids for personalized health

guidance. In addition, hospital management should improve patient data collection and analysis to comprehensively understand the characteristics and needs of their patient population.

6.1.3 Doctors

Chronic disease management greatly relies on the principles and practices of evidence-based medicine. Chronic disease doctors should stay updated on the latest evidence-based research to improve clinical decision making and minimize unnecessary delays, which will enable them to allocate sufficient time for knowledge sharing. As chronic disease patients are predominantly elderly patients or patients with multimorbidity, doctors must improve their communication skills and utilize health education aids to quickly understand patient needs and effectively convey knowledge, so as to improve knowledge sharing efficiency. Meeting these two prerequisites—professional competence and communication skills—can maximize the efficiency of time utilization in doctors' knowledge sharing.

To balance job effort with knowledge sharing practice, chronic disease doctors should strive to optimize their schedules and energy allocation in busy clinical work, avoiding reductions in knowledge sharing efforts due to excessive workloads. To this end, they can consider optimizing workflows, making a priority list, and seeking peer support to ensure they have enough time and energy for knowledge sharing with patients. Additionally, to further enhance knowledge sharing efficiency, doctors can build a dedicated team for knowledge sharing by collaborating with nurses, pharmacists, or other medical professionals. Through collaborative cooperation, they can jointly provide guidance and support to patients, assisting with some of the knowledge sharing tasks of doctors.

Positive feedback can stimulate and enhance doctors' behavioral intention to knowledge sharing. Chronic disease doctors should actively cultivate a long-term and positive doctor-patient relationship. By doing so, they can receive positive feedback from patients, experience a sense of value and accomplishment in their work, and gain recognition and support from peers, which in turn, will further encourage doctors to actively engage in sharing medical information, expertise, and best practices.

6.1.4 Patients

Patients' high expectations regarding their health status may potentially encourage doctors to place greater emphasis on the transparency and comprehensiveness of knowledge sharing. To

ensure all concerns are addressed by doctors, when seeking medical consultation, chronic disease patients should clearly articulate their feelings and needs, proactively report their health management progress, and prepare a list of questions. This proactive approach not only helps patients better understand their treatment plans but also can effectively motivate doctors to share more medical knowledge, thus creating a positive feedback loop, which is conducive to enhancing patient health literacy and improving doctor-patient trust.

Patients' active engagement in medical decision-making processes may facilitate doctors in developing a stronger intention to knowledge sharing. To motivate doctors' intention to share medical knowledge, chronic disease patients should maintain a friendly and cooperative attitude and manner and respect doctors' professional insights and treatment recommendations. When patients demonstrate a desire for medical knowledge and respect for doctors' expertise, doctors will perceive the value of their profession through patients' recognition, thus enhancing their professional confidence. This positive two-way interaction can encourage doctors to devote more time and energy to knowledge sharing and ensure that patients receive the most useful medical information for their health management.

Positive feedback from patients can serve as direct evidence of treatment effectiveness, enhancing doctors' sense of professional achievement and self-confidence, thereby motivating them to share knowledge. During the long-term management of chronic diseases, patients should adhere to their doctors' guidance and advice, including maintaining a healthy lifestyle, conducting regular checkups, keeping records of health condition changes, and identifying potential risk factors in a timely manner. These proactive efforts will enable patients to achieve more effective self-management and enhance their trust in doctors, leading to better cooperation in treatment, improved health outcomes, and the establishment of a positive cycle in chronic disease management.

6.2 Theoretical contributions

(1) Expanding TPB's application

In the literature, TPB has been widely applied to explain the knowledge sharing behavior among employees (Olayemi & Olayemi, 2021; Sudibjo & Prameswari, 2021). For instance, in the medical field, studies on knowledge sharing have primarily focused on interactions among doctors (Almashmoum et al., 2023), between doctors and nurses (Mamo Mulate & Gojeh, 2020), and among nurses (Kim & Park, 2015). In recent years, some studies have explored healthcare professionals sharing knowledge with patients on social media or online forums (Lin et al.,

2016; Xia et al., 2021). However, there is limited research applying the TPB framework to investigate the knowledge sharing behavior between doctors and patients in the context of chronic disease management. This study validated the effectiveness of TPB in such cross-disciplinary applications and provides theoretical support for explaining and predicting chronic disease doctors' knowledge sharing behavior in the specific context of China's healthcare environment.

(2) Understanding the role of knowledge sharing

In China, improving communication has been repeatedly emphasized as key to restoring doctor-patient relationships (Wang et al., 2016). Effective communication can help to reduce health literacy disparities and enhance patients' overall health literacy (Chen & Kapadia, 2022; Veenker & Paans, 2016). However, doctor-patient communication encompasses both verbal and non-verbal interactions (Lee et al., 2002; Mast, 2007), with knowledge sharing constituting only part of verbal interaction. The impact of doctor-patient communication on patient health literacy and doctor-patient relationships does not fully equate to the impact of knowledge sharing. By extending the TPB framework, this study revealed the intrinsic link between chronic disease doctors' knowledge sharing behavior and improvements in patient health literacy. It underscores the doctor's critical role as both a disseminator of knowledge and a promoter of health in chronic disease management. Moreover, the study revealed that perceived patient health literacy partially mediated the relationship between doctors' knowledge sharing behavior and doctor-patient trust. These findings highlight the central role of chronic disease doctors' knowledge sharing in establishing and maintaining doctor-patient relationships.

(3) Examining sequential mediation effects in knowledge sharing

The facilitators, processes, and outcomes of knowledge sharing are interrelated and influence each other linearly (Yeboah, 2023). Sequential mediation effect analysis can help to reveal the intricate relationships mediated by multiple variables between independent and dependent variables. While most studies of knowledge sharing focus on the influencing factors, the sequential mediation effects have been underexplored. By examining the sequential mediation effects, this study confirmed the complex paths linking chronic disease doctors' attitudes toward knowledge sharing, subjective norms for knowledge sharing, perceived behavioral control for knowledge sharing, behavioral intention to knowledge sharing, actual behavior of knowledge sharing, perceived patient health literacy, and doctor-patient trust. The constructed model illuminates the pivotal role of knowledge sharing in enhancing patient health literacy and emphasizes its profound impact on establishing doctor-patient trust. In addition, the model provides a more comprehensive framework for studying doctor-patient trust and

offers a new perspective for future research on the outcomes of doctors' knowledge sharing behavior.

(4) Introducing job effort as a moderator

In Western countries, doctors' consultation times are often regulated (Temple, 2014). In contrast, Chinese doctors receive up to 100 patients per day (X. Zhang et al., 2021) and work more than 40 hours a week (Chen et al., 2020). Furthermore, there is a mismatch between Chinese doctors' workload and compensation (Jiang et al., 2014). Doctors' knowledge sharing behavior may not be adequately recognized or rewarded under the existing remuneration system (Jeong, 2012; Wagner et al., 1996). By introducing job effort as a variable, this study demonstrated its weakening effect on chronic disease doctors' knowledge sharing behavior and their subsequent evaluations of patient health literacy. The findings indicate that under high-intensity work pressure, chronic disease doctors may face barriers such as time constraints, distracted attention, and heavy workloads, which hinder the stable conversion of knowledge sharing intention into actual behavior and may even impair the assessment of patient health literacy. This study provides a novel theoretical explanation for understanding chronic disease doctors' behaviors under high workloads and sheds light on the complexity and diversity of their knowledge sharing behaviors in China's healthcare context.

6.3 Limitations and future research

Within the TPB framework, this study explored the influencing factors and outcomes of chronic disease doctor's knowledge sharing behavior, as well as the moderation effect of job effort therein. Despite adhering to rigorous research design and quality control standards, certain limitations remain, which provide opportunities for future research.

First, although the research sample covered multiple provinces and cities, ensuring a certain degree of geographical diversity, it did not include all provinces and cities in China, nor did it encompass chronic disease doctors from other countries. This geographical and national limitation may restrict the generalizability of the findings to a broader context. Furthermore, given the critical role of doctors' knowledge sharing in chronic disease management, the study specifically targeted chronic disease doctors. It remains unclear whether the constructed model is applicable to doctors in other medical fields. Future research can consider expanding the sample scope to include physicians from diverse regions, hospital levels, and specialties, so as to test the model's universal applicability.

Second, this study used a cross-sectional design to reveal the relationships between the

variables but could not directly examine their causal relationships. While the study preliminarily explored the positions of the variables in the theoretical model by swapping their positions, this approach is insufficient to confirm their causal relationships definitively. Future research can consider employing longitudinal studies or intervention experiments to more accurately identify the causal relationships between the variables.

Third, the data in this study primarily relied on self-reported responses from doctors. Although procedural control measures and common method bias tests were implemented, self-reported data may still be affected by social desirability bias and recall bias. Future studies can consider combining objective data, such as medical records or electronic health archives, or conducting survey on both doctors and patients for a multi-source data validation.

Lastly, this study employed quantitative analysis methods to process data and derived inferential conclusions based on statistical results. However, quantitative approaches often struggle to capture the nuances of the interactions among variables. Future research can consider employing qualitative methods, such as in-depth interviews or case studies, to complement the findings from quantitative analysis.

6.4 Conclusions

This study applied TPB to examine the factors influencing chronic disease doctors' knowledge sharing behavior. It also extended the theoretical framework by introducing perceived patient health literacy and doctor-patient trust as outcome variables of knowledge sharing. Additionally, it incorporated job effort to examine its moderation effect on the knowledge sharing process.

(1) Doctors exhibited high levels of attitudes toward knowledge sharing, subjective norms for knowledge sharing, perceived behavioral control for knowledge sharing, and behavioral intention to knowledge sharing. The high levels of attitudes may stem from their recognition of the importance of knowledge sharing and the positive feedback received. High subjective norms likely owe to positive expectations from patients, colleagues, and hospital management, while strong perceived behavioral control might result from doctors' confidence in their communication skills and clinical experience. The strong behavioral intention to knowledge sharing may be shaped by the combined effects of positive attitudes, strong subjective norms, and good behavioral control. However, doctors' actual behavior of knowledge sharing was at a medium-high level, indicating potential barriers or challenges in translating intention into behavior.

Doctor-patient trust was reported to be medium-high. It is affected not only by external

conditions but also by the quality of doctor-patient interactions in the consultation room. These findings are of significant value for further understanding the facilitating and hindering factors of doctors' knowledge sharing behavior. Furthermore, perceived patient health literacy was at a medium level, suggesting room for improvement in patient health literacy even after doctor's knowledge sharing. Job effort was found to be medium-high, implying its potential impact on the occurrence and effectiveness of doctors' knowledge sharing behavior.

(2) Significant differences in attitudes toward knowledge sharing, subjective norms for knowledge sharing, and perceived behavioral control for knowledge sharing were observed across different demographic groups. Older doctors exhibited higher levels of attitudes toward knowledge sharing, probably due to positive feedback from patients. Doctors in smaller hospitals showed higher subjective norms, likely influenced by expectations from colleagues and patients. Doctors with less tenure, younger age, or lower professional titles reported lower perceived behavioral control, likely due to limitations in their professional competence, communication skills, and resource acquisition capabilities. These findings generally align with the core ideas of TPB.

Female doctors demonstrated stronger behavioral intention to knowledge sharing, likely driven by their social roles, empathy, and communication skills. Doctors in larger hospitals showed lower behavioral intention and actual behavior, likely constrained by time pressures and policy orientations. Doctors with higher outpatient volumes also reported lower actual behavior, probably also due to time pressures. Doctors with a higher proportion of long-term follow-up patients exhibited greater actual behavior of knowledge sharing, likely due to patient expectations, positive feedback, and the continuity of doctor-patient relationships. Therefore, doctors' knowledge sharing behavior may be a result of the interactions of feedback, expectations, abilities, time, and relationships.

Moreover, older doctors reported greater doctor-patient trust, likely attributable to the continuity of doctor-patient relationships, superior communication skills, and patient expectations. Those with higher professional titles reported greater doctor-patient trust, probably shaped by their higher professional competence. Doctors with fewer long-term follow-up patients reported lower doctor-patient trust, likely due to reduced continuity of doctor-patient relationships. Therefore, the reasons behind the differences in doctor-patient trust across demographic groups are also related to feedback, expectations, abilities, and relationships. The influencing factors of doctor-patient trust share similarities with those of knowledge sharing behavior, which suggests a potential association between the two. These findings provided insights for the subsequent development of a coherent theoretical model.

In terms of job effort, the main barrier to doctors' knowledge sharing behavior is resource limitations. Middle-aged doctors tend to have higher job effort, which may be related to their multiple roles and responsibilities. Doctors in smaller hospitals generally have lower job effort, possibly due to the reduced job demands and intensity in these institutions. These findings provided insights for further exploring the moderation role of job effort between related variables.

(3) Attitudes toward knowledge sharing were found to be positively associated with behavioral intention, probably due to chronic disease doctors' recognition of the importance of knowledge sharing and the positive feedback from patients. Subjective norms for knowledge sharing were also positively related to behavioral intention, which may be explained by the expectations of patients, colleagues, and organizations. Perceived behavioral control was positively associated with both behavioral intention and actual behavior, which may be due to doctors' professional competence, communication skills, and time management abilities. Additionally, behavioral intention was positively related to actual behavior. All these findings are in line with TPB.

The actual behavior of knowledge sharing was found to be positively associated with perceived patient health literacy. In the field of chronic disease management, after knowledge sharing, doctors may immediately perceive changes in patients' health awareness in the consultation room, or may perceive improvements in patients' health management abilities during long-term follow-up. Furthermore, actual behavior of knowledge sharing was positively associated with doctor-patient trust. Doctors' knowledge sharing behavior can lead to patients' recognition of doctors' expertise in the consultation room and help build doctor-patient trust during long-term follow-up. Moreover, perceived patient health literacy was also positively associated with doctor-patient trust. In the consultation room, doctors are more likely to quickly reach a consensus with patients who have high health literacy. During long-term follow-ups, patients with high health literacy are often considered to be compliant with medical advice and effectively managing their health. Therefore, in chronic disease management, doctors' knowledge sharing behavior is not only conducive to improving patient health literacy but can also help to establish and strengthen the trust between doctors and patients.

In addition, behavioral intention to knowledge sharing partially mediated the relationship between perceived behavioral control for knowledge sharing and the actual behavior of knowledge sharing. This finding suggests that chronic disease doctors may not have full control over the necessary abilities, resources, and opportunities when performing knowledge sharing. In addition, the direct effect of perceived behavioral control on actual behavior was greater than

the mediation effect of behavioral intention in this process. Therefore, it is crucial to create a supportive environment for doctors' knowledge sharing at the organizational level. Furthermore, perceived patient health literacy partially mediated the relationship between actual behavior of knowledge sharing and doctor-patient trust. The knowledge sharing behavior of chronic disease doctors not only can improve patient health literacy but also helps to maintain and foster the continuity of the doctor-patient relationship, ensuring long-term and effective health management for chronic disease patients. Moreover, the direct effect of actual behavior of knowledge sharing on doctor-patient trust was greater than the mediation effect of perceived patient health literacy in this process. Therefore, supporting doctors' knowledge sharing behavior essentially aligns with a patient-centered care philosophy. Furthermore, behavioral intention to knowledge sharing, actual behavior of knowledge sharing, and perceived patient health literacy had a sequential mediation effect on the relationship of attitudes, subjective norms, and perceived behavioral control with doctor-patient trust. Therefore, adopting a TPB-based comprehensive strategy to promote chronic disease doctors' implementation of knowledge sharing is a beneficial attempt that can enhance patient health literacy and increase doctor-patient trust.

Lastly, job effort weakened the positive relationship between behavioral intention and actual behavior, as well as the positive relationship between actual behavior and perceived patient health literacy. High job effort and frequent interruptions during consultations may hinder the translation of behavioral intention into actual behavior. Besides, patient health literacy is the most direct indicator of the effectiveness of doctors' knowledge sharing behavior. However, it is also the most likely to be negatively influenced by job effort. Due to time constraints and fatigue, doctors may not have sufficient opportunities and energy to accurately perceive changes in patient health literacy.

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Annex A: Additional Tables

Table A.1 KMO and Bartlett's test of sphericity results for each variable

Variable	KMO	Bartlett's test of sphericity		
		Approx. Chi-Square	*df*	*p*
ATT	.861	1476.557	10	< .001
SN	.763	1825.592	10	< .001
PBC	.609	890.877	6	< .001
BI	.812	1387.559	6	< .001
AB	.862	1678.102	10	< .001
PPHL	.773	1514.183	6	< .001
DPT	.827	1200.505	6	< .001
JE	.745	1024.010	3	< .001

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

Table A.2 Standardized factor loadings, AVE, and CR of all variables

Variable	Item	Standardized factor loading	AVE	CR
ATT	ATT1	.710	.590	.877
	ATT2	.846		
	ATT3	.784		
	ATT4	.711		
	ATT5	.781		
SN	SN1	.476	.580	.869
	SN2	.722		
	SN3	.771		
	SN4	.871		
	SN5	.894		
PBC	PBC1	.826	.444	.743
	PBC2	.852		
	PBC3	.447		
	PBC4	.410		
BI	BI1	.818	.655	.882
	BI2	.928		
	BI3	.846		
	BI4	.612		
AB	AB1	.643	.618	.889
	AB2	.839		
	AB3	.857		
	AB4	.816		
	AB5	.757		
PPHL	PPHL1	.596	.661	.884
	PPHL2	.812		
	PPHL3	.931		
	PPHL4	.874		
DPT	DPT1	.791	.633	.873
	DPT2	.882		
	DPT3	.859		

Variable	Item	Standardized factor loading	AVE	CR
JE	DPT4	.864	.726	.888
	JE1	.850		
	JE2	.822		
	JE3	.882		

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

Table A.3 CFA on multi-factor models

	AIC	BIC	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
8-factor model	41436	42009	1527	499	3.060	.919	.908	.058	.053
PBC+ATT	41882	42424	1987	506	3.927	.883	.870	.069	.065
PBC+ATT+BI	42512	43028	2629	512	5.135	.832	.816	.083	.066
PBC+ATT+BI+SN	43206	43699	3332	517	6.445	.777	.758	.095	.070
PBC+ATT+BI+SN +AB	44956	45415	5099	525	9.712	.638	.613	.120	.157
PBC+ATT+BI+SN +AB+PPHL	46539	46966	6695	532	12.585	.512	.485	.138	.189
PBC+ATT+BI+SN +AB+PPHL+DPT	47883	48284	8052	538	14.967	.405	.379	.152	.219
PBC+ATT+BI+SN +AB+PPHL+DPT+ JE	48908	49291	9084	542	16.760	.323	.299	.161	.225

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.

Table A.4 CITC and validity analysis of each scale

Variable	Item	CITC	Cronbach's α if item deleted	Cronbach's α
ATT	ATT1	.664	.858	.875
	ATT2	.765	.833	
	ATT3	.717	.847	
	ATT4	.671	.857	
	ATT5	.721	.846	
SN	SN1	.466	.890	.864
	SN2	.732	.823	
	SN3	.758	.816	
	SN4	.743	.823	
	SN5	.753	.819	
PBC	PBC1	.521	.711	.750
	PBC2	.537	.702	
	PBC3	.598	.665	
	PBC4	.565	.685	
BI	BI1	.756	.834	.877
	BI2	.843	.797	
	BI3	.783	.822	
	BI4	.576	.897	
AB	AB1	.607	.889	.885
	AB2	.784	.847	
	AB3	.782	.846	
	AB4	.739	.856	
	AB5	.716	.861	
PPHL	PPHL1	.600	.901	.882

Variable	Item	CITC	Cronbach's α if item deleted	Cronbach's α
DPT	PPHL2	.792	.829	.866
	PPHL3	.815	.820	
	PPHL4	.777	.836	
	DPT1	.644	.865	
	DPT2	.772	.812	
	DPT3	.734	.823	
	DPT4	.739	.820	
JE	JE1	.780	.840	.887
	JE2	.762	.855	
	JE3	.799	.822	

Note: AB = actual behavior of knowledge sharing; ATT = attitudes toward knowledge sharing; BI = behavioral intention to knowledge sharing; DPT = doctor-patient trust; JE = job effort; PBC = perceived behavioral control for knowledge sharing; PPHL = perceived patient health literacy; SN = subjective norms for knowledge sharing.