

Impact of the Leader Physician's Ability on the Performance of Online Medical Teams

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ABSTRACT

As group services in OHCs are becoming more popular, the role of the leader physician is becoming increasingly important. This study aims to explore the mechanisms by which the leader physician affects the performance of online medical teams. This research employs a two-way fixed effects model to study the impact of the leader physician's abilities on performance and examines the moderating effects of the cooperation mode of a team and the leader's involvement in the online medical team.

Keywords: Online health community, online medical team, leader physician, cooperation, performance.

INTRODUCTION

Online health communities (OHCs) such as Haodaifu, and Guahao have emerged as crucial platforms for health information dissemination and medical consultation (Goh *et al.*, 2016). These platforms cater to millions of users globally, enabling them to access health knowledge and seek medical advice. In China, 80% of patients seek online information about their symptoms before visiting a hospital (Wu & Lu, 2017). In OHCs, group service has recently become one of the most distinctive features (Qiao *et al.*, 2021). The leader is responsible for inspecting the team's online consultations and making key decisions for the team. Understanding how they impact team performance is crucial for optimizing the group service.

Despite the widespread use and growing significance of OHCs, there is limited research focusing on the abilities of leader physicians' impact on team performance. Most existing studies have primarily examined the influencing factors of online consultation and reputation in OHCs, such as doctor's efforts (Liu *et al.*, 2014) and team diversity (Yang *et al.*, 2021). Offline and online medical services differ in several ways, including the scope and depth of service and the doctor-patient relationships. Online medical services offer remote consultations through platforms. Factors such as their quality, and the quality of their written influence patients' evaluations and trust in the doctors (Gong *et al.*, 2021; Jiang *et al.*, 2022).

In this paper, we aim to investigate the relationship between the abilities of leader physicians and the performance of medical teams in OHCs. Based on the evaluation framework for physician capabilities on online medical platforms (Geng *et al.*, 2023), we believe that leader physicians with different levels of abilities have varying impacts on team and individual performance. Our expected contributions are as follows. First, it expands the understanding of how the abilities of leader physicians affect both team and individual performance in OHCs. Second, it emphasizes the importance of team cooperation mode and leader involvement as moderating factors, offering practical insights for managing online medical teams. Finally, the study lays the groundwork for future research to explore the relationship between team performance and individual performance in OHCs.

LITERATURE REVIEW

Research on Online Health Communities (OHCs)

Online Health Communities (OHCs) consist of three main elements, including information, users, and the community itself. Information encompasses various interactive behaviors that reflect user needs, emotions, and attitudes, and user medical data. Users include participants, managers, and contributors who consume health and medical information. The community includes a system, cultural environment, and institutional mechanisms for users.

In the aspect of information, Fan *et al.* (2019) examined effect of features on information quality and knowledge acquisition, while Mukherjee *et al.* (2014) studied credibility of user statements in OHCs. In the aspect of user, researchers have concentrated on user health information behaviors and doctor-patient interactions in OHCs. Lu *et al.* (2019) analyzed patients' acceptance of physician-patient interaction, and Audrain-Pontevia and Menvielle (2018) explored factors influencing patient trust in and satisfaction with their physician. In the aspect of community, studies have looked into the use of virtual communities and blogs for health communities (Eysenbach *et al.*, 2004).

Research on Performance in OHCs

Performance plays an important role in OHCs as it measures economic benefits and directly influences both the community and the doctors. Also, it reflects patient choices. Current research mainly focuses on the impact of user factors on performance.

Deng *et al.* (2019) investigated how the online reputation of doctors affects individual performance. Qiao *et al.* (2021) studied how joining a team improves personal online consultations and reputation, which leads to increased individual performance. Yang *et al.* (2021) researched the positive impact of reputation diversity and experience diversity on team performance.

Research on Online Medical Teams

Nowadays, hospitals provide medical services with medical teams. The diversity of medical teams significantly affect team output (Webber & Donahue, 2001). However, offline medical teams face limitations in diversity due to regional and technological constraints, and a lack of flexibility. The emergence of OHCs has given rise to online medical teams as a key form of telemedicine.

Online medical teams as knowledge-based teams, benefit from diversity, acquiring valuable insights and resources through interaction and discussion, which leads to more innovative solutions and enhanced work efficiency. Wu and Deng (2019) found that knowledge collaboration improves communication among doctors, enhancing the quality of service. However, there is limited research on online medical teams from the perspective of key characteristics of knowledge-based teams, such as knowledge heterogeneity and information sharing.

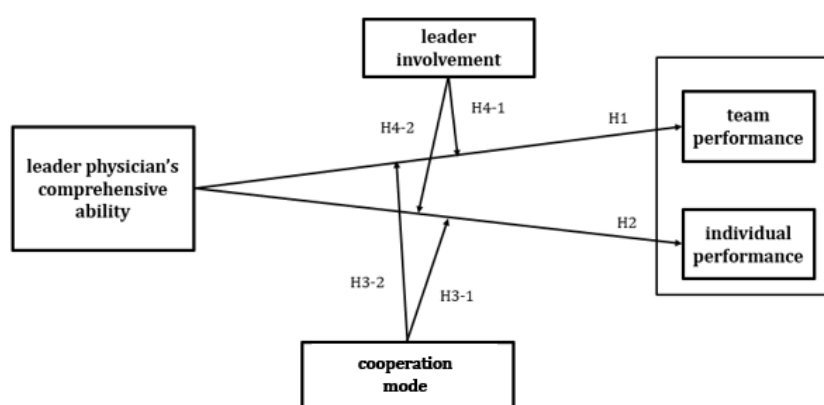
Online medical teams as virtual teams, can form diverse groups across regions and hospitals, and they typically conduct consultations through text. Yang *et al.* (2021) explored the impact of diversity of reputation and experience within online medical teams. Liu *et al.* (2014) examined how individual reputations and other team members affect the number of individual consultations. Jiang *et al.* (2022) studied online medical teams by analyzing the conciseness and emotional aspects of dialogue texts.

In online medical teams, the leader plays a pivotal role in ensuring team stability and the quality of decision-making. The leader physician holds the authority to select team members. These selections are primarily based on considerations of team output and performance. Wu and Deng (2019) highlighted that the capabilities of the leader physician are crucial for effective knowledge collaboration within the team, significantly enhancing service outcomes. Many studies position the leader physician as a moderating variable, implying the unique role of leader physicians in a team.

Previous studies mostly explored the impact of physician's quality or team characteristics on team performance. Our research examines the impact of the abilities of leader physicians on both team performance and the leader's performance.

HYPOTHESES DEVELOPMENT

Figure 1 depicts our research model. We examine how the behavior of leader physicians within online medical teams affects both team and individual performance through the lens of signaling theory and social exchange theory. Besides the main effect, we are also interested in how team cooperation mode plays a moderation role in this process. Finally, we will examine the moderating effect of leader involvement in an online medical team.



Source: This study.
Figure 1: Research Model

Impact of Leader Physician's Ability

From the perspectives of signaling theory and previous research findings, there is a positive effect between the capability of the leader physician and team performance (Webb *et al.*, 1998; Hooper *et al.*, 1993). When the leader physician's abilities are low, improvements in their abilities lead to a corresponding rise in the number of team consultations. However, research on team conflict suggests that, as the volume of consultations grows, it may intensify task and relationship conflicts within the team (Foncubierto-Rodríguez *et al.*, 2022). Such team conflicts lead to a decline in the team performance (Mooney *et al.*, 2007). Consequently, the relationship between the leader physician's abilities and team performance may have an inverted U-shaped pattern.

According to signaling theory, the leader physician acts as a crucial signal in reducing information asymmetry during patient decision-making. This not only affects team performance but also influences personal reputation. Also, the role of the leader physicians in a team would positively impact their individual performance (Li *et al.*, 2019). Therefore, this study posits that an increase in the leader physician's abilities positively influences their performance as an individual physician and proposes the following hypothesis:

- H1: The ability of the leader physician has an inverted U-shaped effect on team performance.
- H2: The ability of the leader physician has a positive effect on leader's individual performance.

Team cooperation mode

Online medical teams may operate in two modes: the single physician consultation service and the collaborative consultation service. In the single physician consultation, one single physician on the team is responsible for diagnosing and serving a patient's consultation. In contrast, in the collaborative consultation, multiple physicians will handle a patient's consultation together. When a patient opts for team-based consultation, their case is integrated into the medical team's information system. This enables individual doctors or multiple doctors to engage in case discussions, issue medical orders, and record the execution of these orders.

Li *et al.* (2019) found that interacting with multiple doctors increases patient reassurance. Such interaction allows patients to feel they have a more comprehensive understanding of their symptoms and receive more accurate diagnoses. According to the Kohler effect, cooperation enhances the quality of service, thereby positively impacting performance. Moreover, the cooperation mode facilitates knowledge exchange among members, improving the overall competence of the team. From the perspective of team conflict, effective team cooperation indicates they have clearer task definitions and fewer internal conflicts, resulting in a relatively minor negative impact of team conflict on team performance. Therefore, this study posits that a team's cooperative mode moderates the influence of the leader physician's abilities on team performance.

An increase in the frequency of collaboration consultations necessitates the leader physician to devote more time and effort to coordination and communication. This reduces the time that leader physicians can allocate to individual consultations on the platform. Thus, this study hypothesizes that a team cooperative mode moderates the effect of the leader physician's abilities on his/her performance as an individual performance, leading to the following hypothesis:

- H3-1: In cooperation mode, the positive effect of the ability of a leader physician on team performance is more significant.
- H3-2: In cooperation mode, the positive effect of the ability of a leader physician on the leader's individual performance is reduced.

Leader involvement

In virtual teams, the leadership can have varying impacts on the team and its performance. From the perspective of power distribution, leaders can be categorized as participative leaders and directive leaders. Participative leaders tend to balance power among members and solve problems collaboratively. Both leadership styles can enhance member engagement and team performance in virtual teams (Kahai *et al.*, 2004). Qu and Xi (2022) noted that virtual teams with participative leaders are characterized by higher member engagement.

In OHCs, we consider leader physicians to spend more time and effort within the team and engage in group service delivery as participative leaders. Previous research has shown that participative leadership in virtual teams can enhance member engagement and team performance. For leader physicians with similar levels of capabilities, those who adopt a participative leadership style can promote member engagement and improve their overall service capabilities through collaborative problem-solving. Therefore, we posit that a leader's active involvement in team activities may lead to differences in team performance.

However, as the leader physician's ability increases, the benefits of knowledge and experience exchange among members strengthen the influence of ability on individual performance. We therefore propose that:

- H4-1: The impact of the ability of leader physicians on team performance is significantly amplified, when the leader physicians exhibit higher involvement.
- H4-2: The impact of the ability of leader physicians on team performance is significantly amplified, when the leader physicians exhibit higher involvement.

METHODOLOGY

Data Collection

The data for this study were sourced from the Haodf platform, one of the largest online health communities in China, which facilitates online consultations. Established in 2006, Haodf has, as of 2023, registered 904,015 doctors from 10,083 accredited hospitals, including 260,943 experts offering online consultation services.

The dataset was obtained by web scraping information on 1,800 online medical teams from the Haodf platform, covering the period from January 2018, when team services began on the platform, to October 2020, totaling 34 months. This 34-month cross-sectional data forms a panel dataset that includes variables such as the number of monthly online consultations per team, the historical consultations by doctors, article publications, and the total patient volume received.

Key Variables

Table 1 describes our key variables and their measurements. Note that for calculating the comprehensive abilities of leader physicians, we will employ primary and secondary indicators of the comprehensive evaluation system (Geng *et al.*, 2023).

Table 1: Key Variables and Measurements

Type / Name	Measurements
Independent Variables	
Team Performance	number of group service consultations in a month
Individual performance	number of leader's individual service consultations in a month
Dependent Variables	
Ability	the ability of the leader physician
Control Variables	
Experience	the historical outpatient volume of the medical team
Participation	the number of physicians participating in consultation responses in a month
Moderating Variable	
Cooperation mode	a dummy variable that is equal to 1 if the proportion of collaborative consultation in a month is greater than that of services involving only a single doctor; and to 0 otherwise
Leader involvement	a dummy variable that is equal to 1 if the leader physician's involvement in collaborative consultation services in a month is greater than 0 and to 0 otherwise

Source: This study.

Model Choice

This study uses ordinary least squares (OLS) regression to test the proposed hypotheses. The results of the Hausman test ($\chi^2=222.340$, $p<0.001$) indicate a preference for the fixed effects model. The fixed effects model helps eliminate heterogeneity and improves estimation efficiency. To account for heterogeneity across individual physicians and time intervals, we employ a two-way fixed effects model, controlling for both individual and time effects. This approach allows us to mitigate the impact of unobserved individual characteristics and temporal factors on the dependent variable.

PRELIMINARY RESULTS FROM THE OBSERVATIONAL DATA ANALYSIS

To provide some preliminary evidence to support our hypotheses, we specified our econometric model using two types of performance as the dependent variable as follows:

$$team\ performance_{it} = \beta_0 + \beta_1 \ln(ability)_{it} + \beta_2 \ln(ability)_{it}^2 + \beta_3 X_{it} + \lambda_t + u_i + \varepsilon_{it} \quad (1)$$

$$individual\ performance_{it} = \beta_0 + \beta_1 \ln(ability)_{it} + \beta_2 \ln(ability)_{it}^2 + \beta_3 X_{it} + \lambda_t + u_i + \varepsilon_{it} \quad (2)$$

where $team\ performance_{it}$ represents the total number of group service consultations provided by team i in month t on the Haodf online health platform, $individual\ performance_{it}$ represents the total number of leader physicians' individual consultations provided in month t . $\ln(ability)_{it}$ represents the capabilities of the leader physician i in month t , parameters β_1 and β_2 capturing the non-linear effects of these capabilities on performance. X_{it} represents the aforementioned control variables, including the physician's experience with online medical services and participation, u_i represents the time fixed effect for the month; λ_t represents the physician individual fixed effect.

$$team\ performance_{it} = \beta_0 + \beta_1 \ln(ability)_{it} + \beta_2 \ln(ability)_{it}^2 + \beta_3 cooperation\ mode_{it} + \beta_4 cooperation\ mode_{it} \cdot \ln(ability)_{it} + \beta_5 X_{it} + \lambda_t + u_i + \varepsilon_{it} \quad (3)$$

$$individual\ performance_{it} = \beta_0 + \beta_1 \ln(ability)_{it} + \beta_2 \ln(ability)_{it}^2 + \beta_3 cooperation\ mode_{it} + \beta_4 cooperation\ mode_{it} \cdot \ln(ability)_{it} + \beta_5 X_{it} + \lambda_t + u_i + \varepsilon_{it} \quad (4)$$

where *cooperation mode_{it}* is a dummy variable that is equal to 1 if the proportion of collaborative consultation in a month is greater than that of services involving only a single doctor; and to 0 otherwise.

$$team\ performance_{it} = \beta_0 + \beta_1 \ln(ability)_{it} + \beta_2 \ln(ability)_{it}^2 + \beta_3 leader\ involvement_{it} + \beta_4 leader\ involvement_{it} \cdot \ln(ability)_{it} + \beta_5 X_{it} + \lambda_t + u_i + \varepsilon_{it} \quad (5)$$

$$individual\ performance_{it} = \beta_0 + \beta_1 \ln(ability)_{it} + \beta_2 \ln(ability)_{it}^2 + \beta_3 leader\ involvement_{it} + \beta_4 leader\ involvement_{it} \cdot \ln(ability)_{it} + \beta_5 X_{it} + \lambda_t + u_i + \varepsilon_{it} \quad (6)$$

where *leader involvement_{it}* is a dummy variable that is equal to 1 if the leader physician's involvement in collaborative consultation services in a month is greater than 0 and to 0 otherwise.

Regression results are shown in Table 2. The coefficients for both the linear and quadratic terms of leader physician's capabilities are significant in Model 1 and Model 2, which support H1 and lead to the rejection of H2. The coefficient of the interaction term in H3 is also significantly positive, which supports H3-1 and leads to the rejection of H3-2. The coefficients for leader physician's abilities and the interaction term with leader involvement are significantly positive, indicating that greater involvement by the leader physician amplifies the positive effect of their abilities on both team performance and individual performance, rendering H4 also confirmed.

Table 2: Fixed-Effects Regression Results

	Model 1 team performance	Model 2 individual performance	Model 3-1 team performance	Model 3-2 individual performance	Model 4-1 team performance	Model 4-2 individual performance
ln(ability)	-49.5594*** (-10.3203)	1.8e+03*** (46.2543)	-51.5302*** (-10.8093)	1.7e+03*** (46.0131)	-76.5694*** (-3.9088)	2.0e+03*** (23.8103)
ln(ability) ²	-47.6109*** (-7.2100)	1.2e+03*** (22.0835)	-49.7751*** (-7.5937)	1.1e+03*** (21.8652)	-73.1531** (-2.5133)	1.5e+03*** (12.1271)
participation	2.0313*** (68.8197)	2.0049*** (8.5863)	2.6381*** (73.3504)	1.8451*** (6.4346)	2.1209*** (17.1877)	-0.7618 (-1.4409)
experience	-0.0007 (-0.9871)	0.1137*** (20.3222)	-0.0018*** (-2.6329)	0.1133*** (20.2405)	-0.0188*** (-8.0531)	0.1200*** (12.0200)
cooperation mode			-3.7916*** (-22.0220)	-5.0403*** (-3.6718)		
ln(ability) * cooperation mode			2.6529*** (3.8039)	32.7781*** (5.8949)		
leader involvement					-1.7966*** (-3.6404)	0.7858 (0.3716)
ln(ability) * leader involvement					7.7613*** (3.6304)	29.5886*** (3.2301)

_cons	-10.1732*** (-10.1687)	442.7180*** (55.9365)	-10.5487*** (-10.6260)	441.6587*** (55.8013)	-12.0343*** (-3.3133)	440.1638*** (28.2828)
N	53720	53720	53720	53720	13498	13498
R ²	0.2831	0.4050	0.2946	0.4054	0.3776	0.6731

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: This study.

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