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Configurational Paths of Preconditions to Transformational Leadership Among Core Hospital Leaders: A Fuzzy-Set Qualitative Comparative Analysis

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Purpose: Transformational leadership among core hospital leaders boosts medical organizations' competitiveness, adaptability, and sustainability, which is jointly affected by individual, organizational and environmental factors. This study aims to unpack its configurational framework and propose strategies to strengthen core hospital leaders' transformational leadership.

Patients and Methods: Data were collected from an online questionnaire among 31 core hospital leaders. The fuzzy-set qualitative comparative analysis (fsQCA) was used to explore the causal mechanism of high-level transformational leadership. We enrich this mechanism by professional background, critical thinking, initiative spirit, family-work conflict, job satisfaction, subordinates' followership, and work pressure.

Results: Result shows initiative spirit is the only necessary condition (consistency=0.911) for the formation of high-level transformational leadership among core hospital leaders. Three configurations are the sufficient conditions that lead to high-level transformational leadership among core hospital leaders with two different professional backgrounds (overall solution consistency= 0.952).

Conclusion: Core hospital leaders' initiative spirit is an indispensable condition for improving high-level transformational leadership, emphasizing the necessity for core leaders to be proactive in order to develop such leadership. Besides, the study also uncovered three configurations are the sufficient conditions for core hospital leaders with diverse professional backgrounds to achieve high-level transformational leadership. This finding offers significant insights into hospital management practices, suggesting that core hospital leaders' work should be managed in a personalized manner based on their professional backgrounds, thereby fostering favorable conditions conducive to the development of their high-level transformational leadership capabilities. Furthermore, the central insight of this study is that the formation of high-level transformational leadership contingent upon the collaboration of professional background, critical thinking, initiative spirit, family-work conflict, job satisfaction, subordinates' followership, and work pressure, contributing to a holistic and more rigorous view for the development of transformational leadership.

Keywords: transformational leadership, core hospital leaders, hospital management, configuration, fsQCA

Introduction

In the swiftly progressing age, medical environment across the globe are undergoing unprecedented transformations. In particular, advancements in medical technology and the widespread adoption of medical informatization are gradually transforming the traditional medical model towards greater efficiency, precision, and humanization. These changes have also imposed heightened demands on the management of medical organizations. In this context, transformational

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leadership, a type of leadership that can stimulate team potential and drive continuous organizational progress, has gradually emerged as a focus in the field of organizational management. Transformational leadership emphasizes that leaders leverage their charisma, inspiration, intellectual stimulation, and individualized consideration to unlock the potential of subordinates, thereby driving the organization to achieve transformations that surpass existing goals.[1] As one of the largest developing countries, China's healthcare system is undergoing profound reform. Many hospitals strive to adapt to the facing challenges through improvements in organizational structure, service optimization, and technological innovation. Transformational leadership, with its distinct advantages and profound influence, stands at the forefront of guiding hospital organizations through the unprecedented challenges and opportunities arising from China's healthcare reform and medical technology advancements.[2] Better than traditional leadership, it is effectively equipped to cope with new challenges and changes, attracting widespread attention and in-depth research in organizational management.[3]

The concept of transformational leadership stems from the leadership theory.[3] With the continuous research of scholars, leadership theory can be evolved into four distinct stages: the trait theory stage, the behavior theory stage, the contingency theory stage, and the emerging new leadership theory stage.[4] The new leadership theory represents a continuous, multi-faceted, and dynamic process that transcends the mere fulfillment of employees' material needs, delving into their psychological and spiritual realms as well.[5] Transformational leadership stands as a prominent exemplar within this new leadership. It is a process in which a leader has the motivation to inspire subordinates through a business philosophy and moral values, enabling subordinates to fully engage in their work,[6] which was first conceptualized systematically by Burns in his research among political leaders. Compared with traditional leadership, transformational leadership focuses not only on the completion of tasks, but on deep-level interaction and mutual growth between leaders and subordinates.[7] Subsequently, the theory of transformational leadership, enriched and refined through the developments by numerous scholars, has firmly established itself as one of the most influential leadership theories. However, the academic community has yet to reach a consensus on the structural dimensions of transformational leadership because of the disparities in cultural contexts. A prevalent and now widely acknowledged model is that articulated by Bass, which comprises four dimensions of transformational leadership: charisma, inspirational motivation, intellectual stimulation, and individualized consideration.[8] Li Chaoping proposed a localized transformational leadership model based on the Chinese context and culture, including charisma, inspirational motivation, individualized consideration and morale modeling. Besides, they crafted the Transformational Leadership Questionnaire (TLQ), tailored specifically to the Chinese context and culture by adapting the Multifactor Leadership Questionnaire (MLQ) originally devised by Bass.[9] This questionnaire has now been widely recognized and has been applied to the measure of transformational leadership in many groups in China.[10]

Core hospital leaders include the Party secretaries and the hospital presidents. It is a group that combines professionals mainly from medical field and management filed. Their responsibilities lie not only in managing the daily operations of the hospital, but also in guiding the hospital to maintain competitiveness and achieve sustainable development in the complex medical environment.[11] As key participants of healthcare reform, the core hospital leaders play a pivotal role to ensure the success in the transformation process of the reform. Researches have shown that leaders with transformational leadership often possess a strong sense of workplace well-being,[12] which fills them with confidence and enthusiasm for their work. In addition, leaders with transformational leadership play a pivotal role in diverse aspects encompassing organizational performance,[13] organizational innovation,[14] organizational commitment,[15] and employee development,[16,17] thereby rendering it an indispensable competency for core hospital leaders and serve as the pivotal factor in sustaining hospital's competitiveness within the rapidly evolving medical environment.[18,19] It is thus evident that developing transformational leadership among core hospital leaders is of paramount importance.

Prior to exploring how to develop transformational leadership, it is imperative to delineate the critical factors that affect transformational leadership and their underlying causal mechanisms. Research on the influencing factors of transformational leadership has achieved rich results. Rubin concluded that there is a positive correlation between personality and transformational leadership behavior in the research of 145 managers of a prominent biotechnology company.[20] Mao and Chen analyzed the critical thinking and transformational leadership of 396 managers through empirical research, and the results showed a significant positive correlation between critical thinking tendencies and transformational leadership.[21] The research by Rowold suggested a significant positive correlation between employee job

autonomy and job satisfaction and transformational leadership.[22] Obviously, these related researches have only focused on the relationship between a single factor and transformational leadership, while scant attention has been paid to the intricate influence of multiple factors on this leadership style. These traditional linear studies often isolate factors and causal processes into independent components, thus neglecting their systemic properties. Furthermore, in exploring the influencing factors of transformational leadership, we recognized that the formation of this leadership style is not solely determined by either exogenous or endogenous factors in isolation, but rather it arises from the cooperation of the two. The individual qualities of leaders serve as the driving force of transformational leadership, while external factors provide the arena and conditions for these qualities to be fully expressed.[6] Therefore, it is necessary for management scholar to explore the causal mechanism of multiple factors influencing transformational leadership from a configurational perspective.

Given this, the study aims to fill this gap by addressing the following questions: What configurations of conditions can facilitate the formation of high-level transformational leadership of core hospital leaders? And how can we effectively enhance their transformational leadership capabilities?

To address these questions, this study introduced qualitative comparative analysis (QCA) method into the research of transformational leadership, as Du Yunzhou has proposed that set theory methods are more suitable for exploring the complex causalities of a phenomenon compared to traditional linear methods.[23] QCA is a method proposed by Charles C. Ragin, which is based on set theory and Boolean algebra. It aims to construct and interpret complex causal relationships from a configurational perspective. QCA is particularly suitable for studying how multiple factors work together to produce a specific outcome or phenomenon,[24] which has been widely applied in both management and sociology studies.[25,26] In this study, seven conditions that influence transformational leadership were identified through the analysis of literature and interview data. Based on the theoretical framework of the triadic reciprocal determinism,[27] these conditions were integrated into three categories: individual, organizational, and environmental conditions. This process ensured that the setting of conditions for QCA not only aligned with practical situations but also possessed a solid theoretical foundation. Individual conditions include professional background, critical thinking, and initiative spirit. Organizational conditions include family-work conflict and job satisfaction. Environmental conditions include subordinates' followership and work pressure. Within the framework of this theory, individual factors, organizational factors and environmental factors do not unilaterally impact transformational leadership, but instead, they are interwoven. These interactions are ultimately reflected through the leader's transformational behaviors, encompassing aspects such as decision-making, communication, motivation, and team building.[28] Specifically, this study aims to use the fsQCA method to unpack the causal mechanism through 7 conditions that collectively fostering the formation of high level transformational leadership among 31 core hospital leaders from 6 hospitals in China, and propose strategies to improve their level of transformational leadership, which will enrich the research of transformational leadership.

Methodology

Case Collection

Cases for this study were collected from an online questionnaire survey conducted from November to December 2022 among core hospital leaders from six hospitals, located in Harbin, Heilongjiang Province, China. All these hospitals boast a comprehensive array of medical specialties, a robust technical team, and a relatively advanced digital infrastructure, which makes them representative to be considered for transformational leadership study. The inclusion criteria of participants are as follows: (1) The participant should be the member of the hospital's core leading group (including the president, vice president, party secretary, and deputy party secretary). (2) The participant should possess a minimum of one year's experience in hospital management. We adopted a cluster sampling method to select the research participants, ensuring that the cases integrated into QCA should have common backgrounds or characteristics.[24] Finally, we obtained 32 questionnaires, among which 31 were valid with an effective rate of 96.9%.

In addition, appropriate quantity of cases depends on the number of conditions for the outcome. Marx and Dusa found a consistent solution and mentioned that a research model with 7 conditions should contain at least 27–29 cases.[29] The recommended number of cases for the QCA method ranges from 10 to 60, and thus our selection of 31 cases is

appropriate to preclude any "limited diversity" that may arise from a smaller sample size.[30,31] These cases include both core hospital leaders with high-level transformational leadership and those with low-level transformational leadership so that the cases are representative for exploring the configurations affecting the formation of high-level transformational leadership among core hospital leaders.

All procedures performed in the study involving human participants were in accordance with the Declaration of Helsinki and ethical principles.

Analysis Method

The Qualitative Comparative Analysis (QCA) is a method that can identify the configurations that lead to a certain outcome from a limited number of cases,[32] which is suitable for dealing with complex causal mechanisms. Compared to correlational approach, QCA takes into account not only the impact of a single condition, but also the combinations of conditions.[24,33] Additionally, QCA supports the existence of multiple paths leading to the same outcome, espousing the principle of equifinality.[34] By integrating the strengths of both qualitative and quantitative methodologies, QCA provides us a comprehensive tool to deeply explore and comprehend complex phenomena. This method not only allows for a rich and nuanced understanding of the subject matter but also validates and refines these insights through rigorous data analysis and logical operations, which makes the research results not only verifiable in theory, but also applicable in practice.[35] According to the type of condition, QCA is divided into crisp-set QCA (csQCA), multi-value QCA (mvQCA), and fuzzy-set QCA (fsQCA).[25] Compared with csQCA and mvQCA, fsQCA can deal with not only the category data, but also the degree condition.[36] It is suitable for continuous data studies, where the state of the conditions can be more precisely described and the objectivity and confidence of the results can be improved.[37] So this study used the fsQCA method to analyze the complex causal mechanisms of the formation of high-level transformational leadership among core hospital leaders, making it a valuable research.

Measurement

Outcome

Measurement of Transformational Leadership

We used an 8-item scale developed by Li Chaoping, which was published in the context of Chinese culture and has been confirmed by subsequent studies to have good reliability and validity.[10] In this study, the scale can be utilized to appraise the level of transformational leadership among core hospital leaders. This scale is evaluated through a five-point Likert scale, with scores ranging from 1 (indicating strong disagreement) to 5 (indicating strong agreement). The higher the overall score, the higher the level of transformational leadership it represents. The Cronbach's alpha of the scale in this study was 0.991.

Conditions

According to the principle of selecting conditions in QCA method, the ideal number of conditions is 4–7 and no more than 8.[38] Based on the review of related literatures, we conducted interviews with 13 core hospital leaders from 6 hospitals in Heilongjiang Province, focusing on the theme of "What are the core conditions for fostering high-level transformational leadership?" Subsequently, drawing upon the triadic reciprocal determinism theory, we distilled seven conditions that impact transformational leadership. The conditions were categorized into individual, organizational and environmental conditions based on the framework of triadic reciprocal determinism theory. Individual conditions include professional background, critical thinking, and initiative spirit. Organizational conditions include family-work conflict and job satisfaction. Environmental conditions include subordinates' followership and work pressure.

Measurement of Professional Background

We use an item "Were you a medical professional or a management professional in the past?" to investigate the professional background. The answer comprises two options: medical professional and management professional.

Measurement of Critical Thinking

We used the critical thinking scale by Jiang Jing in China,[39] which was revised from Facione.[40] Each item was measured ranging from 1 (strongly disagree) to 5 (strongly agree). Furthermore, the Cronbach's alpha of the scale stands at 0.930, indicating a high level of reliability.

Measurement of Initiative Spirit

The item "In the course of my work in hospital management, I believe that I have the initiative spirit." was used to measure initiative spirit. The score range for this item is from 1 (strongly disagree) to 5 (strongly agree).

Measurement of Family-Work Conflict

We employed the item "Even while working at the hospital, I inevitably find myself constantly preoccupied with matters pertaining to my family." to gauge the extent of family-work conflict.[41] This item is gauged from 1 to 5, with 1 representing strong disagreement and 5 representing strong agreement.

Measurement of Job Satisfaction

The single-item "How satisfied are you with your job?" was employed as a metric to gauge job satisfaction.[42] This item is measured ranging from 1 (indicating strong dissatisfaction) to 5 (signifying strong satisfaction).

Measurement of Subordinates' Followership

To assess subordinates' followership, we employed an item stating, "When I disagree with others, my subordinates unswervingly stand in solidarity with me".[43] The score range for this item is from 1 (strongly disagree) to 5 (strongly agree).

Measurement of Work Pressure

To quantify work pressure resulting from healthcare reform, we utilized an item stating, "I feel pressured to implement policies issued by the state pertaining to healthcare reform".[44] This item is gauged from 1 to 5, with 1 representing strong disagreement and 5 representing strong agreement.

It has been proven that the single item not only demonstrates accredited reliability, but also possesses scientific validity in organizational studies and the Chinese medical field.[45,46]

Table 1 shows the abbreviations and interpretations of all the conditions and the outcome.

Calibration

Calibration is the primary step in QCA, which involves the process of calibrating conditions and outcome in cases into sets by selecting appropriate anchor points.[52] We averaged some of the conditions according to Fiss P C's research,[53] and adopted percentile calibration with direct calibration methods, establishing the full membership, crossover point and non-membership thresholds at the 95th, 50th and 5th percentiles, respectively.[24] In addition, We used dichotomy to assign values to "Professional Background".[54] Then we calibrated the conditions and outcome by using fsQCA 3.0 software to convert the initial data into fuzzy-set data. In line with established studies, We recalibrated each set, ensuring an exact 0.5 membership score by adding a small constant (0.001) to prevent the exclusion of any cases.[32] The calibration thresholds for the conditions and the outcome are shown in Table 2.

Results

Necessary Conditions Analysis

Following the calibration is the necessity analysis of a single condition, aiming to ascertain whether certain condition serves as an indispensable prerequisite for the formation of high-level transformational leadership.[55] Consistency serves as a crucial criterion in the necessity analysis. If the consistency of a condition is over 0.9, it can be considered a necessary condition for the result.[30] When the outcome was set to the "High-level transformational leadership of core hospital leaders (TL)", the result shown in Table 3 reveals that only initiative spirit (consistency=0.911) is the necessary condition for the formation of high-

Table 1 Abbreviations and Interpretations of the Conditions and the Outcome

Type	Dimension	Name	Abbreviation	Interpretation
Conditions	Individual Conditions	Professional Background	PB	It refers to whether the core hospital leader was previously a medical professional or a management professional.
		Critical Thinking	CT	It refers to a purposeful and self-correcting value judgment, which includes the interpretation, analysis, evaluation and demonstration of practical problems.[47]
		Initiative Spirit	IS	It refers to the spirit and ability to take proactive actions to achieve work goals, with this behavior being spontaneous and able to persevere in the face of difficulties and obstacles.[48]
	Organizational Conditions	Family-Work Conflict	FWC	It refers to the role stress that occurs when an individual is faced with the incompatibility between the two roles of work and family in some aspects.[49]
		Job Satisfaction	JS	It refers to a psychological state where individuals have positive feelings towards the work itself and its related aspects during the process of working within an organization.[50]
	Environmental Conditions	Subordinates' Followership	SF	It refers to the behavior where subordinates actively identify with and fully support leaders and their goals, promoting organizational development through effective collaboration and interaction.[51]
		Work Pressure	WP	It refers to the extent of the pressure felt by individuals in the process of implementing healthcare reform policies issued by the state or hospitals.
Outcome		Transformational Leadership	TL	The level of transformational leadership among core hospital leaders.

Table 2 Calibration Threshold for the Conditions and the Outcome

Type	Name	Calibration		
		Fully In	Crossover Point	Fully Out
Conditions	PB	0	—	1
	CT	4.8	4	3.6
	IS	5	4	3
	FWC	4	2	1
	JS	5	4	2.5
	SF	5	4	2
	WP	4.5	3	1.5
Outcome	TL	6	5	4.5

level transformational leadership among core hospital leaders. Moreover, no additional condition surpassed the 0.9 consistency threshold, indicating that none of them is indispensable for the desired outcome to materialize. To delve deeper into the intricate mechanisms, the analysis of configuration is deemed imperative.

Table 3 Results of Necessary Conditions Analysis (outcome=TL)

Condition	Consistency	Coverage
PB	0.682	0.527
~PB	0.318	0.600
CT	0.841	0.841
~CT	0.515	0.625
IS	0.911	0.758
~IS	0.384	0.615
FWC	0.545	0.622
~FWC	0.741	0.780
JS	0.773	0.792
~JS	0.613	0.721
SF	0.748	0.783
~SF	0.648	0.745
WP	0.515	0.748
~WP	0.811	0.715

Note: "~" represents "not" or "absent".

Analysis of Sufficiency

The sufficiency analysis follows the analysis of necessary conditions. Firstly, a truth table needs to be constructed to identify what combinations of conditions may lead to the outcome. Relevant research suggests that the frequency threshold for small and medium-sized samples should be set at 1.[30] Given that the number of cases in this study is 31, this setting was adopted accordingly. In addition, consistency threshold was set to 0.8, and PRI consistency threshold was set to 0.75.[56]

The fsQCA software yielded 3-form solutions including complex solutions, simple solutions and intermediate solutions. Intermediate solutions are widely accepted as a solution by most researches for the reason that the conclusions of the analysis are objective in nature and have a high degree of applicability. Therefore, we used the intermediate solutions to interpret the configurations that lead to high-level transformational leadership of core hospital leaders.[57]

Results of the sufficiency analysis reveal that three configurations are sufficient for the formation of high-level transformational leadership among core hospital leaders. We named them initiative-resilience type, initiative-harmony type, and management-oriented type respectively according to the characteristic of each configuration. Typically, scholars combine the parsimonious and intermediate solutions to determine each solution's core and peripheral conditions. The condition which appears in both intermediate solution and simple solution is regarded as the core condition, and the condition which appears only in intermediate solution is regarded as the peripheral condition.[33] Table 4 shows the results of the sufficiency analysis of configurations by the seven conditions.

Table 4 Results of the Sufficiency Analysis of Configurations (outcome=TL)

Conditions	Configuration 1	Configuration 2	Configuration 3
	Initiative-Resilience Type	Initiative-Harmony Type	Management-Oriented Type
Professional Background	⊗	⊗	●
Critical Thinking	●	⊗	●
Initiative Spirit	●	●	●
Family-Work Conflict	●	⊗	⊗
Job Satisfaction	●	●	●
Subordinates' Followership		⊗	⊗
Work Pressure	⊗	⊗	⊗

(*Continued*)

Table 4 (Continued).

Conditions	Configuration 1	Configuration 2	Configuration 3
	Initiative-Resilience Type	Initiative-Harmony Type	Management-Oriented Type
Consistency	0.981	0.965	0.937
Raw Coverage	0.121	0.065	0.305
Unique Coverage	0.082	0.027	0.305
Overall Solution Consistency	0.952		
Overall Solution Coverage	0.452		

Notes: The symbol "●" represents the existence of the core condition, "•" represents the existence of the peripheral condition, "⊗"represents the absence of the core condition, "⊗"represents the absence of the peripheral condition, and empty cell indicates an irrelevant condition.[53]

Both the overall solution consistency (0.952) and the overall solution coverage (0.452) indicate the configurations identified in the solution can lead to the formation of high-level transformational leadership among core hospital leaders, and explain a substantial portion (45.2%) of cases. We constructed a configuration framework shown in Figure 1.

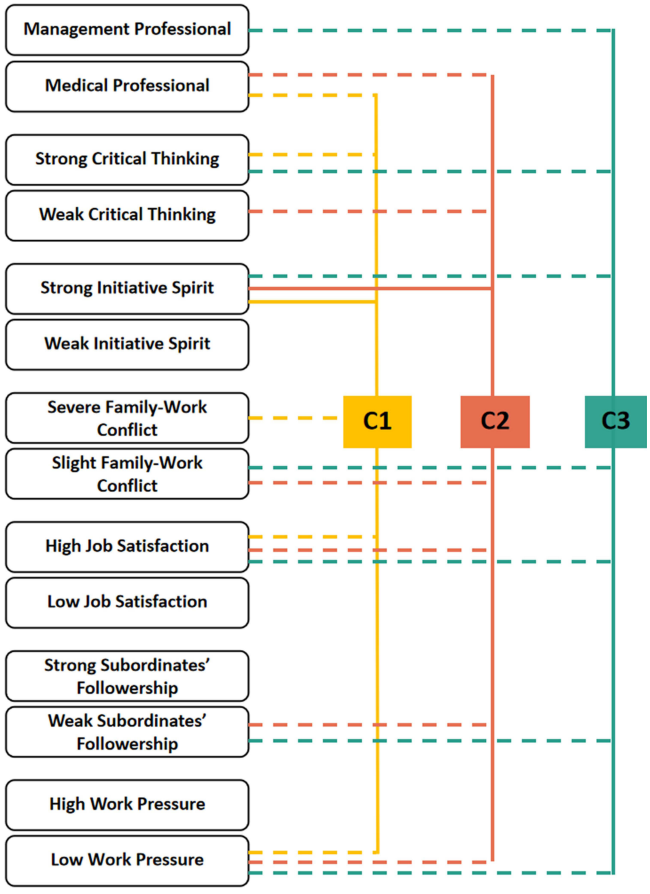

Figure 1 Configuration framework. (outcome=TL).
Notes: "——" represents the core condition, and "-----" represents the peripheral condition. "C1" represents the configuration 1, "C2" represents the configuration 2, and "C3" represents the configuration 3.

Robustness Test

To examine the robustness of our results, we adjusted the threshold of consistency by raising the threshold of consistency from 0.8 to 0.85 based on relevant research results.[52] The new results of configurations were consistent with the analysis results and the fit parameters has not changed, which indicates our results have reliability and robustness.

Discussion

The result show that initiative spirit serves as a necessary condition for the formation of high-level transformational leadership, which suggested that initiative spirit is a valuable resource that plays a vital role in the process of forming high-level transformational leadership among core hospital leaders. The initiative spirit of core hospital leaders refers to their spirit and ability to take proactive actions to achieve work goals, with this behavior being spontaneous and able to persevere in the face of difficulties and obstacles.[48] Lisa's research has indicated that taking the initiative is a crucial element of leadership and an important asset for many jobs, which provides strong support for our conclusion.[58] The research of Rubin confirmed that personality play an important role in the formation of transformational leadership, which also supports our conclusion.[20] Besides, this study identified three configurations that contribute to high-level transformational leadership. According to the composition of each configuration, we named them initiative-resilience type, initiative-harmony type, and management-oriented type respectively. In addition, we found that configurations required for core hospital leaders with different professional backgrounds to form high-level transformational leadership vary. Then we put forward some strategies to enhancing the level of transformational leadership among core hospital leaders based on the results.

Configurations for High-Level Transformational Leadership Among Core Hospital Leaders

Initiative-Resilience Type

In the first configuration named initiative-resilience type (~PB*CT*IS*FWC*JS*~WP), the initiative spirit serve as a core condition plays a central role in higher transformational leadership among core hospital leaders, while other peripheral conditions involving critical thinking, job satisfaction, and family-work conflict play a complementary role in higher transformational leadership among core hospital leaders. Current configuration indicates when core hospital leaders with medical professional background were characterized by strong initiative spirit, strong critical thinking, high job satisfaction, and perceived low work pressure from healthcare reform, they are more likely to keep a high-level transformational leadership under Chinese medical surrounding, although they might suffer severe family-work conflict. This configuration means that the cultivation of initiative spirit has become a key point to improve the change leadership level of core hospital leaders.

Initiative-Harmony Type

In the second configuration called initiative-harmony type (~PB*~CT*IS*~FWC*JS*~SF*~WP), the initiative spirit still plays a central role in fostering high-level transformational leadership among core hospital leaders. This is further complemented by the supportive roles played by critical thinking, and job satisfaction. This configuration suggests that although there is no strong subordinates' followership or strong critical thinking ability, core hospital leaders with medical professional background who possess a strong initiative spirit, coupled with high job satisfaction, slight family-work conflict and perceived low work pressure stemming from healthcare reform requirements, are capable of fostering a high degree of transformational leadership within the medical workplace in China. Similar to configuration 1, both configurations cover the individual, organizational, and environmental conditions. So systematic consideration is thus necessary in order to promote transformational leadership among core hospital leaders.

Management-Oriented Type

In the third configuration entitled management-oriented type (PB*CT*IS*~FWC*JS**~SF~WP), the joint work of initiative spirit, critical thinking, and job satisfaction play the peripheral role to the goal of high-level transformational leadership among core hospital leaders. This configuration indicates that when core hospital leaders with management

professional background who possess strong critical thinking, high job satisfaction, slight family-work conflict and low work pressure stemming from healthcare reform, are capable of fostering high-level transformational leadership in China's medical workplace, despite the absence of strong subordinates' followership. This configuration reveals that, in contrast to core hospital leaders with medical professional background, initiative spirit does not occupy a key role in shaping high-level transformational leadership among core hospital leaders with management professional background. This underscores the importance of considering the unique professional background of individuals when devising strategies to cultivate and enhance transformational leadership, ensuring that tailored recommendations are made accordingly.

Strategies for Improving the Level of Transformational Leadership Among Core Hospital Leaders

Fostering the Initiative Spirit of Core Hospital Leaders

This study discovered that it is a prerequisite for enhancing their transformational leadership capabilities through fostering the initiative spirit among core hospital leaders in hospital management practice. Study hints that it is high time to set up an incentive mechanism achieved through public recognition, financial incentives, or professional development opportunities to promote their initiative spirit. Health policy administrators should establish a positive feedback loop such as by acknowledging and celebrating successful transformational leaders to encourage more core hospital leaders to emulate and learn from experience, further to develop their transformational leadership skills. It makes contribution to strengthening their initiative spirit as well as ensures that they remain a powerful driver of organizational success and innovation. Besides, when evaluating the transformational leadership level of core hospital leaders, scientific and objective indicators are needed with a measurable and operable nature, including decision-making efficiency, teamwork and innovation ability. Clarifying these indicators allows core hospital leaders to be targeted in developing their transformational leadership skills, and it is conducive to the development of initiative spirit.

Fully Capitalizing on the Unique Professional Advantages of Core Hospital Leaders

This study found that core hospital leaders with different professional backgrounds have different configurations for forming high-level transformational leadership. In organizational management, different professional backgrounds may play an important role and exert a profound influence in shaping high-level transformational leadership. Core hospital leaders' diverse professional backgrounds mean different knowledge, skills, and experience, which are all valuable advantages and resources. It is crucial for health policy administrators to comprehend the specific expertise of each core hospital leader, and then rationally allocate the work in the process of work planning to ensure that the professional advantages of each core hospital leader are given full play. In addition, it is the responsibility of health policy administrators to offer more training programs and learning resources for core hospital leaders, thereby facilitating their ongoing professional development and refinement of their competencies to enhance their transformational leadership.

"Individual-Organizational-Environment" Collaboration for Core Hospital Leaders

This study reveals three configurations fostering high-level transformational leadership among core hospital leaders. These configurations underscore the joint work by different conditions of "individual-organizational-environment" system, rendering the development of such leadership in the Chinese context diverse and intricate. So it is necessary for health policy administrators to consider from the perspective of "individual-organizational-environment" collaboration when formulating strategies to enhance their transformational leadership skills. Firstly, as a "key minority" of the hospital, each core hospital leader can be involved in the process of hospital's strategic planning and goal setting, enabling them to better understand the organization's vision and mission, and translate them into personal action guidelines. By aligning individual and organizational development goals, both parties can form a joint force to promote the enhancement of transformational leadership. Moreover, it is crucial to foster an open communication channels and promote open dialogue between health policy administrators and core hospital leaders through the facilitation of regular team meetings, thus health policy administrators can ensure that decisions are informed by a diverse range of perspectives and experiences, leading to more innovative and inclusive leadership strategies. Consequently, core hospital

leaders are empowered to work in a conducive environment for transformation, thereby enhancing their transformational leadership capabilities. In addition, health policy administrators should strive to reduce the conflict between family and work for core hospital leaders, thereby enabling them to carry out their work with peace and ease. For example, health policy administrators can empower core hospital leaders to utilize advanced technological tools, including email, instant messaging software, and online conferencing platforms, to minimize unnecessary face-to-face meetings and streamline their workflows. Furthermore, health policy administrators should encourage the adoption of automation tools and artificial intelligence software to handle repetitive tasks, thereby freeing up core hospital leaders' valuable time and energy that can be better spent with their families. This balanced approach ensures that core hospital leaders' work and family responsibilities are both efficiently and well taken care of, thus enabling them to practice transformational leadership without any worries.

Limitations and Future Research

This study, though valuable in providing insights into the configurations for the formation of high-level transformational leadership among core hospital leaders in China, is not exempt from limitations that offer promising avenues for future research.

Firstly, our study on core hospital leaders from representative hospitals in China has uncovered three pivotal configurations that enable core hospital leaders with diverse professional backgrounds to cultivate high-level transformational leadership, highlighting the intricate nature of the underlying mechanisms. Nevertheless, the scope of our investigation was constrained by resource availability and practical considerations, limiting its reach to hospitals solely within China. Consequently, future studies are encouraged to broaden their sample size, organizational type and geographical scope to further enrich the comprehension of this topic and offer more refined recommendations for organizational management and leadership development. Moreover, we have utilized the QCA method when delving into the study of transformational leadership, offering us a valuable and insightful perspective. However, we must acknowledge that the QCA results cannot fully explain the situation of all the core hospital leaders in our cases. So we hold the aspiration that future research will be backed by more data to enrich the research of transformational leadership. In addition, it is undeniable that our study is a cross-sectional study, which cannot determine the long-term effect of the resulting configurations on transformational leadership, so future research is expected to enrich the dynamic research on transformational leadership through longitudinal temporal data.

Conclusion

Firstly, our findings emphasized the significance of initiative spirit as a prerequisite for achieving high-level transformational leadership among core hospital leaders. In essence, the initiative spirit is a catalyst for leaders to spearhead changes and drive transformation within their institutions. By cultivating this spirit, core hospital leaders can not only enhance their own transformational leadership capabilities, but also foster a positive and productive work environment that benefits the entire organization.

Importantly, we have identified three configurations of forming high-level transformational leadership among core hospital leaders by using fsQCA method. Specifically, the environment of a medical workplace in China is inherently a highly complex and dynamic system. In such an environment, the path towards achieving such high-level leadership is not a straightforward one, but rather a multifaceted and complex journey that is shaped by multiple interconnected conditions. Recognizing this complexity, it becomes imperative to approach the enhancement of transformational leadership from a holistic perspective. This means considering not only the individual characteristics and strengths of core hospital leaders, but also the organizational and environmental factors that shape their leadership capabilities. The intricate interplay between these individual, organizational and environmental factors forms a distinctive system, which must be factored in when devising strategies to foster transformational leadership.

Finally, upon our results, it has become evident that the configurations for cultivating high-level transformational leadership are different for core hospital leaders with different professional backgrounds. This underscores the need for leveraging each core hospital leader's strengths and harnessing the potential inherent in their respective professional backgrounds to effectively enhance the level of transformational leadership. Such tailored approaches not only recognize

the uniqueness of each leader, but also ensure that the leadership strategies implemented are relevant, effective, and sustainable in fostering positive transformation within the hospital setting.

In summary, this study used the fsQCA method to unpack the causal mechanism through 7 conditions that collectively fostering the formation of high level transformational leadership among 31 core hospital leaders from 6 hospitals in China, which significantly enriches the theoretical research on transformational leadership. Furthermore, this study proposed strategies to improve their level of transformational leadership, which advances our understanding of how transformational leadership can be effectively developed in healthcare environments, and provides a reference for the research and practice of transformational leadership in other organizations.

Ethics Approval and Informed Consent

The experimental protocol was established according to the ethical guidelines of the Helsinki Declaration. Due to the anonymous survey approach, written informed consent could not be obtained. A verbal informed consent form was included at the beginning of the questionnaire. And the Institutional Review Board of Harbin Medical University had approved verbal consent for this study. Completing the questionnaire regarded as a verbal consent was therefore considered "informed consent" for participation in the survey. A verbal informed consent has been obtained from the participants to publish this paper.

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Disclosure

The authors declare no conflict of interest.

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