



E-ISSN: 3108-4176

APSSHS

Academic Publications of Social Sciences and Humanities Studies

2024, Volume 5, Issue 2, Page No: 157-168

Available online at: <https://apsshs.com/>

Annals of Organizational Culture, Leadership and External Engagement Journal

Linking Research-Innovation Leadership to Nurses' Innovation Behavior: The Mediating Role of Organizational Climate

Michael Turner¹, Sophia Nguyen^{2*}, David Clark¹, Emma Wilson³

1. Department of Organizational Leadership and Strategic Culture, Faculty of Business and Management, University of Glasgow, Glasgow, United Kingdom.
2. Department of External Engagement and Corporate Communication, Faculty of Business Administration, National University of Singapore, Singapore.
3. Department of Organizational Behavior and Leadership Studies, Faculty of Economics and Management, University of Sydney, Sydney, Australia.

Abstract

To examine how nurses' organizational innovation climate mediates the link between head nurses' research-innovation leadership and nurses' innovation behavior. Employing convenience sampling, 236 clinical nurses were recruited from four tertiary grade-A hospitals located in Hebei Province, China. Information was obtained via four tools: a general information questionnaire, the head nurses' research-innovation leadership scale, the nurses' innovation behavior scale, and the organizational innovation climate scale. SPSS, an online statistical analysis platform, was utilized for descriptive statistics, correlation testing, and structural equation modeling. Head nurses' research-innovation leadership received a mean total score of 55.32 ± 12.18 , placing it in the upper-middle range. Nurses' organizational innovation climate scored 84.35 ± 11.35 overall, indicating a medium level. Nurses' innovation behavior had a total mean score of 34.65 ± 6.21 , indicating a medium level of innovation behavior. Nurses' innovation behavior demonstrated positive associations with head nurses' research-innovation leadership ($r = 0.380$, $P < 0.01$) and with organizational innovation climate ($r = 0.409$, $P < 0.01$). Organizational innovation climate partially mediated the relationship between head nurses' research-innovation leadership and nurses' innovation behavior, explaining 29.6% of the overall effect (95% CI [0.0417~0.1412]); the mediating effect was statistically significant (0 not included in the interval). Head nurses' research-innovation leadership directly influences nurses' innovation behavior and indirectly shapes the organizational innovation climate; however, the indirect pathway does not represent the primary influence. Nursing managers ought to strengthen their research and innovation leadership capabilities and deliberately build a supportive organizational environment to foster innovative behavior among nurses.

Keywords: Clinical nurses, Innovation behavior, Head nurses' research-innovation leadership, Organizational innovation climate, Mediating effect

How to cite this article: Turner M, Nguyen S, Clark D, Wilson E. Linking Research-Innovation Leadership to Nurses' Innovation Behavior: The Mediating Role of Organizational Climate. Ann Organ Cult Leadersh Extern Engagem J. 2024;5(2):157-68. <https://doi.org/10.51847/PxPrGc0giF>

Received: 04 September 2024; **Revised:** 05 December 2024; **Accepted:** 06 December 2024

Corresponding author: Sophia Nguyen

E-mail ✉ sophia.nguyen@gmail.com

Introduction

Nurses' innovative behavior involves the process by which nurses, seeking to advance health promotion, disease prevention, and patient care standards, discover and develop novel methods and techniques before applying them in clinical settings with collaborative team support [1]. The National Nursing Development Plan (2021–2025) underscores that nursing forms an essential element of the healthcare system and calls for energetic advancement of innovation and reform within nursing to build a skilled, high-caliber, and creative nursing workforce [2]. Serving as a cornerstone of the healthcare team, nurses act



© 2025 The Author(s).

Copyright CC BY-NC-SA 4.0

as the chief catalysts for advancements in nursing, with their innovative behavior exerting a substantial influence on elevating the general standard and operational effectiveness of hospital medical services [3]. Innovation functions as the key engine for hospital progress and facilitates superior development across hospital operations [4]. Innovation functions as the key engine for hospital progress. Consequently, identifying effective ways to unlock hospital nurses' creative capacities is a pressing issue for hospital leadership [5]. In tertiary grade-A hospitals, nurses typically work in highly sophisticated professional settings, where hospital leaders place a high priority on developing their innovative skills. Despite initiatives aimed at advancing nurses' innovation behavior, the prevailing standard still needs substantial elevation [6]. Therefore, monitoring the current state of nurses' innovation behavior in tertiary-grade A hospitals is highly relevant.

Head nurses' leadership occupies a central position in hospital administration, especially in safeguarding and advancing the standards of nursing services. By fostering an encouraging atmosphere and allocating sufficient resources for nursing innovation and daily practice, head nurses help create a constructive organizational innovation climate that ignites nurses' inventive thinking and pioneering mindset. This climate represents a key external factor that shapes nurses' innovation behavior while enhancing care standards and the hospital's competitive standing [7]. The specific leadership approaches and styles used by head nurses can directly affect nurses' innovation behaviors [8]. Research and innovation constitute core drivers in the evolution of the nursing field. They play an indispensable role in elevating clinical nursing standards, reducing patient complications, and shortening hospital admissions [9]. Yet, the precise pathways through which head nurses' research-innovation leadership shapes nurses' mindsets and actions related to innovation remain inadequately clarified. Research-innovation leadership among head nurses denotes the capacity of individuals in research-focused roles to direct and oversee research processes, thereby attracting and inspiring nurses and other parties to participate willingly in and sustain research and innovation efforts toward shared objectives [10]. This leadership approach goes beyond personal innovation actions; it encompasses coordinating personnel, materials, and time-based assets to motivate and direct nurses in their units toward fulfilling their innovative capabilities. In the end, it emerges as a potent catalyst for innovation across the entire healthcare network [11].

The organizational innovation climate plays an essential role in shaping nurses' innovation behavior. It supplies the perceptual groundwork required to underpin the growth of innovation-oriented activities. The organizational innovation climate is defined as the collective view held by nurses regarding the degree to which their department, nursing unit, and the broader hospital endorse innovation [12]. Functioning as a personal interpretation of the workplace setting, this innovation climate powerfully determines the level of backing individuals sense when pursuing innovative endeavors. Investigations indicate that a supportive innovation climate within an organization leads nurses to feel more validated in their innovative pursuits [13], which, in turn, activates their innovation behavior. Supporting data further reveal that a constructive organizational innovation climate markedly advances innovation behavior among nurses [14]. Accordingly, nursing leaders must proactively develop an enabling innovation climate, cultivate nurses' innovative mindset, spark their creative drive, and strengthen their innovative abilities [15].

A forward-thinking leadership approach can improve the organizational innovation climate and heighten nurses' sense of innovativeness within their roles [12]. Investigations have identified a positive link between head nurses' leadership and the organizational innovation climate: greater leadership strength from head nurses is associated with a more solid innovation climate, thereby strengthening engagement in innovation behavior [16]. Leadership style shapes the organizational innovation climate, which in turn influences both individual staff members and the institution at large. Head nurses' research-innovation leadership can communicate the significance of nursing research and innovation, provide the resources to turn innovative concepts into reality, cultivate an organizational innovation climate, and, in due course, advance innovation behavior among nurses.

Earlier research has established that nurses' innovation behavior correlates not solely with the organizational innovation climate but also with the leadership approach of head nurses [17]. Considering these insights, the current investigation seeks to assess clinical nurses' views on the organizational innovation climate, head nurses' research-innovation leadership, and nurses' innovation behavior, while probing the mediating role of organizational innovation climate in this association. The outcomes are expected to provide actionable guidance for nursing administrators seeking to strengthen innovation in clinical practice. Given the critical value of nurses' innovative behavior, additional thorough examination is justified. At present, however, few investigations address the specific process by which head nurses' research-innovation leadership affects this behavior through the organizational innovation climate. This research equips hospital nursing leaders with a fresh perspective, grounded in head nurses' research-innovation leadership, to encourage innovative actions among nurses. It advocates for and encourages nursing leadership to increase focus on nursing innovation, ultimately raising the standard of nursing services.

Theoretical framework

The foundation of this investigation rests on Spatial Theory [18, 19], which originates from Field Dynamics Theory [20]. Within this perspective, innovation behavior is formulated as $B_i = f(P_i \times E_i)$. In the equation, B_i denotes overall conduct

(including innovative actions), P_i denotes the individual (including inner motivations, viewpoints, and mental processes), and E_i denotes the surrounding context (including external influences). The function f serves as the multiplier that illustrates how these elements interact. In the model, the innovation participant (P_i) and the innovation surroundings (E_i) operate as mutually dependent factors that collectively create the “innovation space.” In the current research, B_i represents nurses’ innovative behavior, P_i aligns with the organizational innovation climate, and E_i corresponds to head nurses’ leadership.

Applying concepts from spatial and field dynamics, nurses’ innovative behavior emerges as a response to external pressures that disrupt their standard clinical routines. Nurses turn to innovative practices to adjust to an ever-shifting workplace, reestablish stability, and keep delivering reliable nursing care. Spatial Theory posits that personal internal elements (here defined as the organizational innovation climate) and external contextual elements (here defined as head nurses’ research-innovation leadership) collaborate to foster innovative actions among clinical nurses. The perspective also suggests that external conditions can reshape internal perspectives and, in turn, encourage innovation. The joint operation of internal and external elements is anticipated to shape nurses’ innovative behavior, suggesting that internal elements may act as intermediaries for external influences. This investigation employs Space Theory to define the setting for nursing innovation, viewing the nursing unit or department as a multi-layered innovation space. Such a space forms a fluid and multifaceted system built from the physical setting, human interactions, and mental understandings. Nurses’ innovative behavior is either boosted or restrained within this space.

Drawing on the theoretical foundation and earlier studies, the conceptual model for this investigation is presented in **Figure 1**. Even though attention to the subject continues to rise, the links between nurses’ innovative behavior, head nurses’ research-innovation leadership, and the organizational innovation climate have received limited scrutiny. Consequently, the importance of this research lies in analyzing these elements, especially the mediating role of the organizational innovation climate. The core objective is to boost nurses’ innovative behavior and thereby raise the standard and fulfillment levels of nursing services.

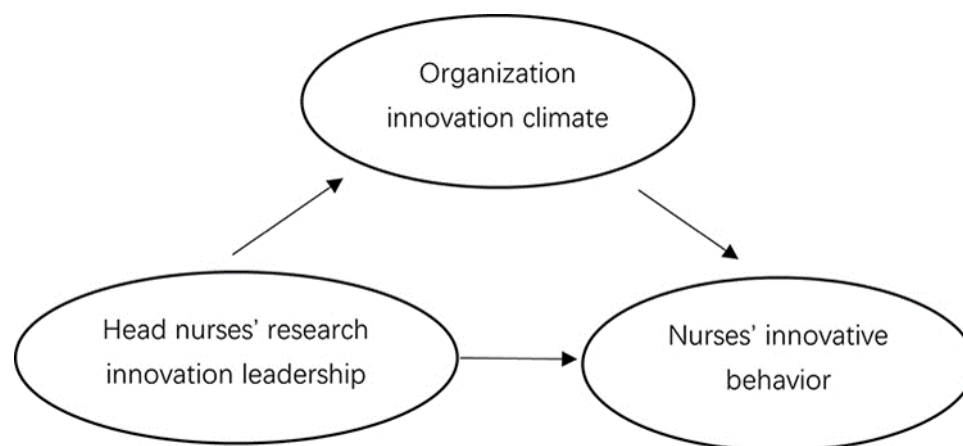


Figure 1. Mediating role model of organizational innovation climate.

The study hypotheses:

- Hypothesis 1: Head nurses’ research-innovation leadership, organizational innovation climate, and nurses’ innovation behavior are positively correlated with one another.
- Hypothesis 2: Organizational innovation climate mediates the relationship between head nurses’ research-innovation leadership and nurses’ innovation behavior.

Materials and Methods

Participants

In March 2025, clinical nurses from four tertiary-grade A hospitals in Hebei Province were recruited via convenience sampling. Inclusion criteria required that participants: (1) be currently employed as registered nurses in the chosen hospitals; (2) provide direct clinical care; (3) have collaborated with their present head nurse for a minimum of one year; and (4) have received information about the study and willingly consented to take part. Exclusion criteria included: (1) nurses who were absent from work during the data collection period (such as those on maternity leave, sick leave, or participating in external training programs); and (2) nurses who had suffered significant physical injury or psychological conditions within the previous two years, evidenced for instance by cumulative sick leave longer than 30 days resulting from physical or traumatic issues, or documented hospitalization for diagnosed psychiatric or psychological disorders.

The necessary sample size was calculated using Kendall’s sample size estimation method [21], which suggests a sample of 5–10 times the number of variables. Considering the 31 variables in this study and a 20% invalid response rate, the estimated

sample size ranged from 186 to 372 participants. In the end, 236 valid questionnaires were collected, meeting the required sample size.

This study is subject to certain limitations and possible selection bias stemming from the convenience sampling approach. The participants were drawn exclusively from four tertiary-grade A hospitals in Hebei Province, which have distinct features and may not accurately reflect the wider nursing population. Additionally, the sample may include only nurses inclined to participate in the survey, potentially affecting the findings.

Instruments

General information questionnaire

A custom-made questionnaire was created to gather participants' basic personal and occupational details. These included gender, age, highest education level, marital status, hospital classification, employment category, working department, total years of nursing experience, professional rank, average monthly salary, and whether the nurse acted as a clinical teaching instructor.

Nurse Innovation Behavior Scale (NIBS)

This research adopted the Nurse Innovation Behavior Scale (NIBS), originally constructed by Bao *et al.* [1] for application among nursing professionals. The instrument comprises three dimensions, totaling 10 items: idea generation (3 items), securing support (4 items), and idea application (3 items). Respondents answer using a five-point Likert-type scale from 1 (never) to 5 (very frequently). Possible total scores range from 10 to 50, with higher scores indicating more evident innovative behavior. The scale demonstrates favorable psychometric properties, with a content validity index (CVI) of 0.91 and a Cronbach's α of 0.879.

Head nurses' research-innovation leadership scale

The scale was designed by Ma *et al.* [22] to measure the research-innovation leadership qualities of head nurses. It features five dimensions—foresight, charisma, influence, decisiveness, and control—and includes 15 items in total. Each statement is evaluated on a five-point Likert scale anchored from 0 (almost never) to 4 (always), generating total scores from 0 to 60. Greater scores indicate more robust research-innovation leadership. The tool has exhibited outstanding validity and reliability, reflected in an overall content validity index of 0.923 and a Cronbach's α coefficient of 0.976.

Nurses' Organizational Innovation Climate Scale (NOICS)

Researchers employed the Nurses' Organizational Innovation Climate Scale, developed by Qian Yan and colleagues [12], to assess nurses' perceptions of the innovation climate in their organizations. This scale comprises 21 items across three dimensions: innovation encouragement (7 items), resource availability (6 items), and managerial practices (8 items). Answers are given on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher aggregate scores reflect a more positive view of the organizational innovation climate. The instrument demonstrates solid reliability and validity, evidenced by an overall Cronbach's α of 0.938.

Data collection

Clinical nurses provided data through an internet-based electronic survey. The investigative team first approached the nursing management units of the involved hospitals to outline the study's aims, value, and procedures, thereby gaining their approval and cooperation. Comprehensive explanations and clear directions for completing the questionnaire were supplied. The nursing offices then circulated the QR code and the online survey link via the head nurses' digital communication groups. Head nurses subsequently shared the link with staff in their units through departmental online platforms. Nurses filled out and returned the questionnaire directly to the research personnel. The initial screen displayed a study overview, instructions for filling out the form, and an informed consent declaration. Participants were notified that responses would remain anonymous, only one submission per IP address was permitted, and every item required a single mandatory selection. Altogether, 580 questionnaires were returned, of which 236 were deemed valid, yielding a valid response rate of 40.7%. The chief reasons for this modest valid response rate include the following: nurses endure intense workloads and place a high value on their limited time, while also regularly encountering numerous surveys, which often trigger survey fatigue and lead to immediate abandonment of the form. Furthermore, the research team released the questionnaire only once and failed to send timely follow-up reminders, causing many nurses to overlook or forget the task. This situation is serious because it may compromise the study's validity and influence the overall conclusions.

Ethical considerations

Ethical permission for the investigation was secured from the Ethics Committee of the Affiliated Hospital of Hebei University (Approval No. HDFYLL-KY-2024-172).

Statistical analysis

All gathered information was kept secure in an encrypted online environment to protect accuracy and privacy. Data processing was executed with SPSS version 25.0. Descriptive statistics offered a general profile of the sample characteristics. Continuous measures were expressed as means accompanied by standard deviations, while categorical measures were summarized using frequencies and percentages. After completing the descriptive stage, Pearson correlation analysis was conducted to investigate associations among the three central variables: nurses' innovation behavior, head nurses' research-innovation leadership, and organizational innovation climate. Structural equation modeling (SEM) was conducted using AMOS version 24.0. The model incorporated the dimensions of nurses' innovation behavior, head nurses' research-innovation leadership, and organizational innovation climate as observed indicators. Path analysis was used to explore the linkages among these variables. Maximum likelihood estimation was applied both to fit the model and to refine it. The analytical procedure consisted of four successive steps: first, inspecting the direct connection between the predictor (head nurses' research-innovation leadership) and the outcome (nurses' innovation behavior); second, evaluating the connection between the predictor and the proposed mediator (organizational innovation climate); third, testing the full set of relationships involving the predictor, mediator, and outcome; and fourth, determining the mediating influence of organizational innovation climate according to the outcomes from the third step. The Bootstrap technique was utilized to assess the statistical significance of the mediation, adopting a significance threshold of $\alpha = 0.05$. A total of 5,000 bootstrap resamples were performed to estimate the direct and indirect effects of organizational innovation climate on nurses' innovation behavior, along with their 95% confidence intervals (CIs).

Results and Discussion

Demographic characteristics of nurses

The final sample consisted of 236 clinical nurses. Within this group, 14 were male (5.9%), and 222 were female (94.1%). Over half of the participants were in the 31–40 age bracket ($n = 123$, 52.1%). Nearly all held a bachelor's degree ($n = 227$, 96.2%), and the majority were married ($n = 190$, 80.5%). Every nurse worked at a tertiary-grade A hospital. Most were employed on a contract basis ($n = 180$, 76.3%). More detailed demographic information is displayed in **Table 1**.

Table 1. Frequency distribution of demographic variables among clinical nurses ($n = 236$)

Variable	Category	%	N
Gender	Male	5.90	14
	Female	94.10	222
Age (years)	20–30	18.20	43
	31–40	52.10	123
	≥ 41	29.70	70
Educational Level	Associate degree or lower	2.50	6
	Bachelor's degree	96.20	227
	Master's degree or higher	1.30	3
Marital Status	Single	18.20	43
	Married	80.50	190
	Divorced	1.30	3
Employment Status	Contract-based	76.30	180
	Permanent staff	23.30	55
	Agency/dispatched	0.40	1
Clinical Department	Internal Medicine	36.00	85
	Surgical units	31.40	74
	Obstetrics/Pediatrics	5.10	12
	Emergency department	6.80	16
	Critical care units	8.50	20
	Other departments	12.30	29
Years of Experience	1–5 years	11.90	28
	6–10 years	29.20	69
	11–15 years	24.60	58
	16–20 years	16.90	40
	≥ 21 years	17.40	41
Professional Title	Staff nurse	5.50	13
	Senior nurse	18.20	43

	Nurse supervisor	61.00	144
	Deputy chief nurse or above	15.30	36
Monthly Income (RMB)	≤ 5000	7.20	17
	5001–10,000	76.30	180
	≥ 10,001	16.50	39
Teaching Responsibilities	Yes	65.30	154
	No	34.70	82
Work Attitude	Negative	1.30	3
	Neutral	44.10	104
	Positive	54.70	129
Research Training Experience	No	55.90	132
	Yes	44.10	104
Core Journal Publications	None	86.00	203
	At least one	14.00	33
Patent Application Experience	None	91.50	216
	Yes	8.50	20
Research Project Applications	None	91.90	217
	Yes	8.10	19
Head Nurse Age (years)	30–40	25.00	59
	≥ 41	75.00	177
Head Nurse Gender	Male	3.40	8
	Female	96.60	228
Head Nurse Educational Level	Associate degree or lower	3.00	7
	Bachelor's degree	85.60	202
	Master's degree or higher	11.40	27
Head Nurse Title	Supervisor	33.10	78
	Deputy chief or above	66.90	158
Head Nurse Clinical Experience	5–10 years	2.50	6
	11–15 years	21.20	50
	≥ 16 years	76.30	180
Head Nurse Management Experience	< 5 years	12.70	30
	5–10 years	50.80	120
	≥ 11 years	36.40	86

Normality test and common method bias test

Normality test

Checking whether data follow a normal distribution is a necessary step before any statistical testing can proceed. To evaluate normality, researchers examined skewness and kurtosis values. Standard guidelines suggest that data can be treated as roughly normal when the absolute skewness is less than 2 and the absolute kurtosis is less than 10. Results from the current study confirmed that all scales met these limits, indicating that the dataset closely approximated a normal distribution. See **Table 2**.

Table 2. Skewness and kurtosis tests of the scales

Variable	Kurtosis	Skewness
Head nurses' research–innovation leadership	−0.187	−0.396
Organizational innovation climate	2.746	−1.215
Nurses' innovation behavior	0.129	−0.593

Common method bias test

Common method bias arises when systematic errors occur due to a shared data-collection source, the measurement technique itself, or the specific language and layout of survey questions [23]. Given that this research depended heavily on self-administered questionnaires, the risk of such bias was carefully assessed. Harman's single-factor test yielded 14 factors with eigenvalues above 1. The largest factor accounted for only 23.52% of the total variance, staying well below the 40% warning level. These outcomes indicate that serious common-method bias was not a concern in the present study.

Scores of head nurses' research-innovation leadership, organizational innovation climate, and nurses' innovation behavior

Head nurses' research-innovation leadership produced an overall mean score of 55.32 ± 12.18 and a mean item score of 3.69 ± 0.81 . Among its dimensions, charisma and influence ranked highest, while foresight ranked lowest (**Table 3**). Nurses' perception of organizational innovation climate showed a total mean score of 84.35 ± 11.35 and a mean item score of 4.02 ± 0.54 . The managerial practices dimension scored highest, followed by innovation encouragement, with resource availability scoring lowest (**Table 4**). For nurses' innovation behavior, the total mean score was 34.65 ± 6.21 , and the mean item score was 3.46 ± 0.62 . The obtaining support dimension achieved the highest score, followed by idea generation, while idea implementation scored lowest (**Table 5**).

Table 3. Scores of head nurses' research-innovation leadership (n = 236)

Dimension	No. of items	Mean $\pm$ SD	Possible score range
Overall Scale	15	55.32 ± 12.18	0–60
Foresight	3	11.08 ± 2.89	0–12
Charisma	3	11.22 ± 3.12	0–12
Influence	3	11.23 ± 2.92	0–12
Decisiveness	3	10.69 ± 3.29	0–12
Control	3	11.10 ± 2.95	0–12

Table 4. Scores of organizational innovation climate (n = 236)

Dimension	No. of items	Mean $\pm$ SD	Score range
Overall scale	21	84.35 ± 11.35	21–105
Innovation support	7	29.92 ± 4.15	7–35
Resource provision	6	22.54 ± 4.69	6–30
Management practices	8	31.89 ± 5.14	8–40

Table 5. Scores of nurses' innovation behavior (n = 236)

Dimension	No. of items	Possible score range	Mean $\pm$ SD
Overall scale	10	10–50	34.65 ± 6.21
Idea generation	3	3–15	10.98 ± 2.03
Support acquisition	4	4–20	13.51 ± 3.11
Idea implementation	3	3–15	10.16 ± 2.45

Correlation analysis among nurses' innovation behavior, organizational innovation climate, and head nurses' research-innovation leadership

Nurses' innovation behavior was positively associated with head nurses' research-innovation leadership ($r = 0.380$, $P < 0.01$) and with organizational innovation climate ($r = 0.409$, $P < 0.01$). Head nurses' research-innovation leadership was also positively associated with the organizational innovation climate ($r = 0.358$, $P < 0.01$). Taken together, these results show strong positive interconnections among all three variables, thereby confirming Hypothesis 1 (**Table 6**).

Table 6. Correlation matrix among the three variables (r values, n = 236)

Variable	3	2	1
1. Head nurses' research-innovation leadership			1
2. Nurses' innovation behavior		1	0.380**
3. Organizational innovation climate	1	0.409**	0.358**

Mediating role of organizational innovation climate between head nurses' research-innovation leadership and nurses' innovation behavior (SEM)

Because the correlation analysis revealed positive links among head nurses' research-innovation leadership, organizational innovation climate, and nurses' innovation behavior, a structural equation model (SEM) was built to investigate the mediating pathway. Following guidance from prior studies, the model was constructed in AMOS 24.0, with dimensions of the three constructs serving as observed indicators (**Figure 2**). Maximum likelihood estimation was employed to calculate model parameters. Fit indices confirmed a strong model fit: Chi-square/df (CMIN/DF) = 1.423 (< 3), Goodness-of-Fit Index (GFI) = 0.956 (> 0.9), Normed Fit Index (NFI) = 0.939 (> 0.9), Comparative Fit Index (CFI) = 0.981 (> 0.9), Incremental Fit Index (IFI) = 0.981 (> 0.9). These statistics indicate that the model fitted the data well overall.

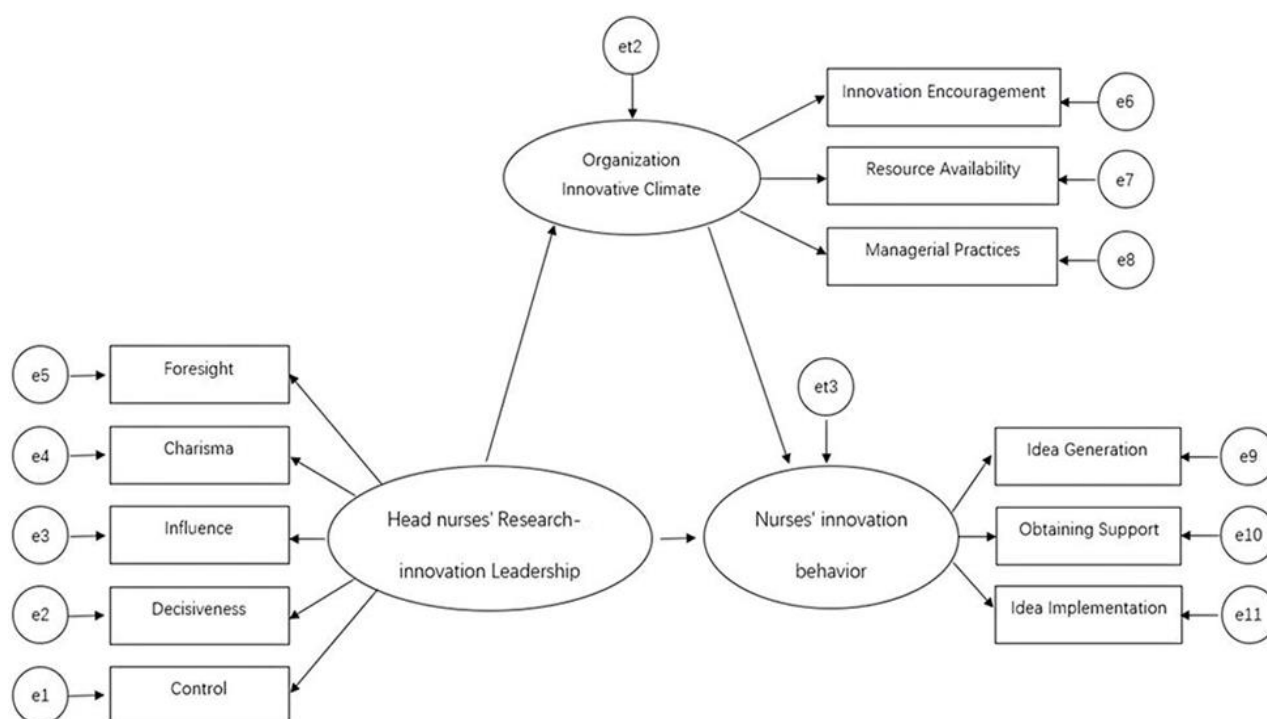


Figure 2. Structural equation model and standardized path coefficients.

Mediating effect of organizational innovation climate

To examine the mediating function of organizational innovation climate, the Bootstrap method was applied using 5,000 resamples. Analysis revealed a total effect of 0.291, a direct effect of 0.205, and an indirect effect of 0.086 for the influence of head nurses' research-innovation leadership on nurses' innovation behavior. The 95% confidence intervals for all three effects did not include zero, indicating statistical significance ($P < 0.001$). These findings demonstrate that the organizational innovation climate partially mediates, explaining 29.6% of the total effect. This result supports Hypothesis 2. Full details are shown in **Table 7**.

Table 7. Bootstrap test of the mediating effect of organizational innovation climate

Effect pathway	% of total effect	P-value	95% CI (Upper)	95% CI (Lower)	SE	Effect estimate
Head Nurses' Research-Innovation Leadership → Organizational Innovation Climate → Nurses' Innovation Behavior	29.6%	< 0.001	0.141	0.044	0.025	0.086
Head Nurses' Research-Innovation Leadership → Nurses' Innovation Behavior	70.4%	< 0.001	0.298	0.112	0.047	0.205
Total effect	100.0%	< 0.001	0.382	0.200	0.046	0.291

Although earlier research has demonstrated that head nurses' research-innovation leadership affects nurses' innovative behavior, the potential mediating role of the organizational innovation climate in this relationship has not yet been empirically tested. The current investigation makes a meaningful contribution by integrating head nurses' research-innovation leadership, the organizational innovation climate, and nurses' innovative behavior within a single framework. This approach expands knowledge about the key influences on nurses' innovation. The results also offer useful theoretical guidance for better managing the nursing workforce.

This study relied on Kendall's sample-size estimation method, which recommends collecting 5–10 times the number of variables. Such an approach might yield a relatively small sample, thereby limiting the internal validity of the findings.

Status quo of nurses' innovation behavior

In the present research, nurses' innovative behavior obtained a mean score of 34.65 ± 6.21 . This value is lower than those reported by Zhang *et al.* [24] and Chen *et al.* [25], yet higher than the score reported by Wang *et al.* [26], suggesting a moderate overall level. The relatively balanced score may stem from the fact that all participants came from well-established tertiary grade-A hospitals. These institutions tend to emphasize innovative practices, regularly organize innovation training workshops, and maintain incentive systems that encourage nurses to propose new ideas.

Across the three dimensions, idea generation received the highest ratings, whereas idea implementation scored the lowest. This pattern suggests that clinical nurses are generally able to think creatively and generate novel solutions when encountering practical challenges, but they often struggle to put those ideas into practice. Several reasons may account for this discrepancy. First, some clinical nurses may have limited formal education, insufficient theoretical grounding, and minimal training in research methods, which weakens their overall awareness of and skills in innovation. Second, the intense workload and restricted time in daily practice [27], combined with inadequate interaction with experienced colleagues, can reduce nurses' capacity to initiate and carry out innovative projects [14]. Third, many nurses remain concerned that introducing new practices might pose risks to patient safety, which in turn discourages them from moving forward with implementation.

To overcome these barriers, head nurses and nursing leaders are encouraged to actively engage with national initiatives that promote healthcare innovation. Developing innovative behavior should be treated as a core element of professional growth for nurses. Administrators need to supply necessary resources such as information, protected time, and financial backing, while actively building a supportive organizational innovation climate. Such efforts can fully engage nurses' motivation and drive for creative work.

Status quo of head nurses' research-innovation leadership

The mean score for head nurses' research-innovation leadership in this study was 55.32 ± 12.18 . This result exceeds the levels reported by Xiang *et al.* [28] and Huang and Chen [29], suggesting a slightly above-average performance. The elevated scores likely reflect hospital leaders' strong focus on developing research-innovation capabilities among head nurses and their recognition that these leaders' personal scientific and creative abilities directly shape the innovative actions of the nurses they supervise.

Among the five dimensions, charisma achieved the highest score, while decisiveness recorded the lowest. This distribution may arise from several influences. Head nurses often have the time and energy to participate in research and innovation activities, particularly when they face requirements for career advancement, which tends to boost their research output. Moreover, they can motivate staff by modeling innovative behavior and fostering a research-friendly environment through their own enthusiasm [8]. Nevertheless, hospital management and head nurses may not consistently allocate sufficient time, staff support, or financial resources during routine operations to help translate nurses' ideas into practice.

To improve this situation, hospital administrators should intensify targeted training programs designed to strengthen head nurses' research-innovation leadership and further refine existing incentive structures for scientific and creative work. Simultaneously, head nurses should be supported in improving daily communication and providing guidance to their teams, with special emphasis on building nurses' research and innovation competencies. These steps could expand access to funding opportunities and increase nurses' appreciation of their leaders' research and innovation capabilities, ultimately advancing the progress of nursing science [30].

Status quo of organizational innovation climate among nurses

Nurses in this study reported a total mean score of 84.35 ± 11.35 for perceived organizational innovation climate. This figure is lower than the score obtained by Lv *et al.* [31] but higher than that reported by Wang *et al.* [26], reflecting a generally positive innovation atmosphere within the sampled hospitals.

Looking at the individual dimensions, managerial practices received the highest ratings, whereas resource availability scored the lowest. These results suggest that nursing managers actively value nurses' input in decision-making processes and offer timely, effective guidance. Consequently, nurses feel more motivated to engage in innovative activities. However, hospitals and their leadership still need to provide stronger policy-level and institutional backing to fully support nursing innovation. Previous investigations have consistently shown that a supportive organizational innovation climate increases nurses' access to leadership encouragement and recognition, which in turn promotes greater innovative behavior. Therefore, nursing administrators should work deliberately to create a robust innovation climate, raise nurses' awareness of innovation opportunities, and expand relevant training to enhance their practical skills. Administrators should also promote involvement in both internal and external innovation projects. Such measures can spark greater enthusiasm and deliver the comprehensive support nurses require to successfully carry out innovative initiatives [14].

Correlation between nurses' innovation behavior, head nurses' research-innovation leadership, and organizational innovation climate

Findings from the current investigation revealed positive associations between the overall and subscale scores of nurses' innovation behavior and head nurses' research-innovation leadership ($P < 0.01$). These outcomes match those previously documented by Xiang *et al.* [28]. As immediate leaders of frontline clinical nurses, head nurses hold a pivotal role in shaping innovative practices. Their guidance in research and innovation directly encourages and advances nurses' creative efforts. Greater strength in head nurses' research-innovation leadership is associated with more frequent displays of innovative actions by nurses.

Furthermore, both the total and subscale scores of nurses' innovation behavior showed positive associations with the organizational innovation climate ($P < 0.01$), echoing earlier observations by Lv *et al.* [31] and Wang *et al.* [26]. This pattern suggests that when nurses perceive a more innovation-friendly atmosphere in their workplace, their engagement in innovative behavior tends to increase. A constructive innovation climate likely provides a supportive external environment that ignites nurses' drive and willingness to experiment, while simultaneously opening more avenues for developing and applying fresh approaches [32]. Assistance from nursing leaders further helps staff convert original concepts into tangible clinical applications.

Organizational innovation climate as a partial mediator between head nurses' research-innovation leadership and nurses' innovative behavior

Data obtained here showed that the organizational innovation climate partially mediates the relationship between head nurses' research-innovation leadership and nurses' innovation behavior, accounting for 29.6% of the overall effect. Head nurses' research-innovation leadership proved to be a meaningful predictor of both nurses' innovation behavior and the surrounding organizational innovation climate. Consequently, this form of leadership impacts nurses' creative conduct through immediate channels as well as through secondary routes that shape the innovation climate. Consistent with prior literature [31], a robust organizational innovation climate is a vital enabler of nurses' successful execution of innovative initiatives. Given that innovation unfolds as a multifaceted, stepwise process, efforts must go beyond merely heightening nurses' awareness of leadership in research and innovation; adequate organizational support is equally essential to ensure the successful translation of ideas into practice.

Accordingly, nursing leaders should intensify their efforts to promote research and innovation across the workforce by instituting sound motivational policies and ensuring adequate personnel, materials, and financial resources. Moreover, securing additional support from outside the immediate organization can create a supportive environment that fully unleashes nurses' creative potential and elevates their innovation performance.

Applying principles from spatial theory, the present work represents the initial attempt to integrate head nurses' research-innovation leadership and organizational innovation climate when studying nurses' innovative behavior. It probes the underlying processes connecting these three elements and substantiates the mediating role of organizational innovation climate. In light of the theoretical observations, hospital managers ought to prioritize advancing nursing innovation principles and embed nurturing creative competencies within nurses' professional growth trajectories. Looking ahead, healthcare facilities might introduce specialized educational modules to bolster leadership capabilities in nursing research and weigh the inclusion of research and innovation achievements as decisive factors in the appointment of head nurses.

Limitations

Several constraints characterize this investigation. First, the online survey format, together with reliance on self-reported responses, could have introduced various biases, such as social desirability effects, in which participants might inflate reports of their own innovative activities. Second, data collection was confined to clinical nurses employed at four tertiary-grade A hospitals in Hebei Province, thereby limiting the extent to which the outcomes can be applied to other nurse groups. Third, the modest questionnaire response rate might have compromised the study's validity, as well as its representativeness and applicability of its conclusions. Fourth, any connection between the group of head nurses and participants' willingness to complete the survey remains undetermined. Lastly, the cross-sectional structure prevents the establishment of definite cause-and-effect relationships. To strengthen applicability, subsequent projects should embrace mixed-methods strategies that blend quantitative measurements with in-depth qualitative exploration for a fuller picture. Broadening the scope to encompass diverse geographic locations and different types of healthcare environments — particularly through multicenter initiatives and substantially larger samples — would help confirm and reinforce the stability and reach of the current conclusions.

Conclusion

Results from this research suggest that head nurses' research-innovation leadership, organizational innovation climate, and nurses' innovation behavior all registered at moderate levels and could benefit from further development. Head nurses' research-innovation leadership and organizational innovation climate both served as notable predictors of nurses' innovation behavior, while clear positive interconnections existed among the three variables. Structural equation modeling demonstrated that organizational innovation climate partially mediates the association between head nurses' research-innovation leadership and nurses' innovation behavior. Nevertheless, this mediating pathway does not dominate entirely; head nurses' research-innovation leadership appears capable of operating through additional unexamined routes, whether immediate or roundabout. Such complexity underscores that nurses' innovative behavior arises from an intricate interplay of numerous contributing

elements. The likelihood of further influences not only makes sense but also directs attention toward a more complete appreciation of the issue.

Drawing on these observations, nursing managers are encouraged to design targeted strategies that harness the power of head nurses' research-innovation leadership, nurture an encouraging organizational climate for innovation, and provide practical support that enables nurses to introduce innovative solutions in everyday clinical environments. Given that the participant pool was restricted to tertiary-grade A hospitals in a single province, subsequent inquiries should include facilities of varying sizes and from multiple geographic zones, using multicenter designs. Increasing the number of participants could also reinforce the reliability and broader relevance of the results.

Acknowledgments: We sincerely thank all the nurses who participated in this study.

Conflict of interest: None

Financial support: This research was supported by Hebei Key Laboratory of precise imaging of inflammation-related tumors, and by Hebei University Research and Innovation team (Innovative team for precise care and rehabilitation of patients with cancer, Grant No. IT2023C07), and by the Health Commission of Hebei Province, under the project titled "2021 Hebei Province Medical Science Research Project" (Grant No. 20210637).

Ethics statement: None

References

1. Bao L, Wang L, Zhang YQ. Development and analysis of reliability and validity of nurse innovative behavior scale. *J Shanghai Jiaotong Univ.* 2012;32(8):1079–82,1087.
2. National Health Commission of the People's Republic of China. Notice on issuing the "National nursing development plan (2021-2025)". *Guoweiyifa* [2022] No. 15 [EB/OL]. 2022-04-29.
3. Barr TL, Malloch K, Ackerman MH, Raderstorf T, Melnyk BM, Morin KH, et al. A blueprint for nursing innovation centers. *Nurs Outlook.* 2021;(1).
4. Zheng Y. Building a research funding management platform for smart hospitals: a case study of hospital U. *Econ Outlook Bohai Sea.* 2022;06:108–10.
5. Jing J, Niyomsilp E, Li R, Zhao Y, Zhang X, Wang C. Effect of workplace fun on Chinese nurse innovative behaviour: the intermediary function of affective commitment. *J Nurs Manage.* 2021;29(7):2250–9.
6. Afsar B, Masood M. Transformational leadership, creative self-efficacy, trust in supervisor, uncertainty avoidance, and innovative work behavior of nurses. *J App Behav Sci.* 2017;002188631771189.
7. Carmeli A, Schaubroeck J. The influence of leaders' and other referents' normative expectations on individual involvement in creative work. *Leadership Q.* 2007;18(1):35–48.
8. Labrague LJ, Toquero LM. Leadership styles and nurses' innovative behaviors: a systematic review. *J Nurs Adm.* 2023;53(10):547–53.
9. Atalla ADG, El-Ashry AM, Samia MSM. The moderating role of ethical awareness in the relationship between nurses' artificial intelligence perceptions, attitudes, and innovative work behavior: a cross-sectional study. *BMC Nurs.* 2024;23(1):1–11.
10. Guo Y, Ma K, Guo L, Liu J, Zhang W, Chen X. Development and psychometric appraisal of head nurse research leadership scale. *Nurs Open.* 2023;10(10):3378–87.
11. Karen KG, Kelly L. Collaborative nurse–engineer product innovation. *Am J Nurs.* 2022;122(7):59–61.
12. Yan Q, Zhang YQ, Wu JM, Bao L, Wang L, Zhu Y. Development and psychometric test of nurse organizational innovation climate scale. *Chin J Nurs.* 2016;51(2):243–7.
13. Zhang YP, Wang H, Luo Y, Zhang DP. Mediating effect analysis of organizational innovation climate between information literacy and innovative behavior among clinical nurses. *J Nurs Admin.* 2023;23(3):200.
14. Liu J. Correlation study on nurses' innovative behavior and nurse innovation climate and resilience. *Chin Nurs Res.* 2019;33(11):1860–5.
15. Zhao HQ. Research on the current status and influencing factors of innovative behavior among emergency department nursing staff. *Modern Nurse.* 2022;29(2):118–21.
16. Kou L, Shang HL. Effect of innovation atmosphere of nurse organization on innovation behavior: based on the intermediary analysis of head nurse leadership style. *Modern Med J.* 2021;49(01):95–9.
17. Ahmed AK, Ata AA, Abd-Elhamid ZN. Relationship between the leadership behaviors, organizational climate, and innovative work behavior among nurses. *Am J Nurs Res.* 2019;7(5):870–8.

18. Wei X, Zhang YQ. Summary of theoretical models related to nurses' innovative behavior. *Shanghai Nurs.* 2019;19(7):53–6.
19. Zhang LM, Chen J, Wang Y, Liu H, Zhao Q, Sun W, et al. Spaces theory of innovation and protection behavior. *Sci Technol Prog Policy.* 2006;23(11):62–5.
20. Wang Z, Zhu Y, Zhan X, Liu Y, Chen L, Zhang H, et al. Problem-solving ability and future time perspective among the Chinese nursing interns: the mediating role of future work self. *PLoS One.* 2024;19(8):e0308669.
21. Fang JQ. *Statistical methods for biomedical research.* Singapore: World Scientific; 2021.
22. Ma KK, Guo LN, Dong XF, Liu Y, Wang L, Zhang W, et al. Development and reliability and validity test of scientific innovation leadership scale for head nurses. *Nurs Res.* 2023;37(8):1375–9.
23. Tang DD, Weng ZL. Common method bias test: issues and recommendations. *J Psychol Sci.* 2020;43(01):215–23.
24. Zhang J, Li XY, Wang L, Zhang YQ, Chen X, Liu M, et al. Effect of innovation atmosphere perception on nurses' innovative behavior and the mediating effect of intrinsic motivation. *J Military Nurs.* 2020;37(05):57–60.
25. Chen X, Yang N, Li QP, Wang L, Zhang Y, Liu J, et al. Relationship between nurse leadership regulation focused behavior, adversity quotient, and innovation behavior. *Chin Nurs Res.* 2024;38(07):1288–92.
26. Wang Z, Yang L, Zhu Y, Liu Y, Chen X, Zhang H, et al. Innovative behavior and structural empowerment among the Chinese clinical nurses: the mediating role of decent work perception. *BMC Nurs.* 2024;23(1):1–13.
27. Zhang XJ, Wang RX, Wang DQ, Li Y, Zhao L, Chen Y, et al. Current situation of innovation ability of clinical nurses in Guizhou Province and its influencing factors. *Chin J Mod Nurs.* 2020;26(7):888–94.
28. Xiang D, Xu Y, Chen L, Wang H, Liu J, Zhang M, et al. Nurses' innovative behavior and its influencing factors of 5 tertiary grade A hospitals in Xi'an. *Chin Nurs Manage.* 2024;24(12):1804–8.
29. Huang HL, Chen YX. A study on the current status and influencing factors of head nurses' leadership in scientific research and innovation. In: *Abstract Collection of the 18th Annual Meeting of Chinese Neurosurgical Doctors, Chinese Medical Doctor Association.* 2024:154.
30. He JH, Zhang HG, Gao X, Wang L, Liu Y, Chen W, et al. The mediating effect of nurses' management care perception on head nurses' leadership and career status. *J Nurs Admin.* 2024;24(4):282–6.
31. Lv M, Yang S, Lv XY, Zhang Y, Wang L, Chen J, et al. Organisational innovation climate and innovation behaviour among nurses in China: A mediation model of psychological empowerment. *J Nurs Manage.* 2021;29:2225–33.
32. Weng RH, Huang CY, Chen LM, Chang LY, Wang YC, Lin SY. Exploring the impact of transformational leadership on nurse innovation behaviour: a cross-sectional study. *J Nurs Manage.* 2015;23(4):427–39.