


Does transformational leadership and psychological empowerment improve nurses' innovative behaviour during COVID-19 outbreak? A cross-sectional study

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Abstract

Aims: To investigate the relationships between transformational leadership, psychological empowerment and innovative behaviour among nurses in China.

Background: The innovative behaviour of nurses is important to adapt to the changing medical environment. However, there is currently a limited understanding of the relationship between nurses' innovative behaviour and transformational leadership and psychological empowerment during the pandemic.

Methods: Convenience sampling was used to conduct an investigation involving 1317 nurses from 10 hospitals in China from January 2022 to April 2022. Data analysis was performed using correlation analysis, univariate analysis and multiple regression analysis. The STROBE checklist was followed when writing this manuscript.

Results: High transformational leadership and high psychological empowerment were associated with high innovative behaviour. The results of the multiple linear regression analysis showed that physical condition, whether or not you have attended academic conferences or whether or not you have participated in fund research projects, transformational leadership and psychological empowerment were the main factors on nurses' innovative behaviour, together explaining 64.5% of the total variance.

Conclusion: Promotion of transformational leadership and psychological empowerment is vital for nurses to promote innovation, thereby meeting the urgent demand for innovative nurses and the rapid development of nursing disciplines.

Implications for Nursing Management: This study highlights the importance of transformational leadership in developing nurses' innovative behaviours. Understanding the role of psychological empowerment can help nurse managers formulate relevant intervention strategies and cultivate nurses' innovative behaviour.

KEYWORDS

COVID-19, innovative behaviour, nurses, psychological empowerment, transformational leadership

1 | BACKGROUND

In the world, there were nearly 28 million nurses, making up nearly 60% of the health care workforce and providing 90% of primary health care services (WHO, 2020b). Nurses were facing tremendous challenges in providing safe and equitable care to all populations in need as the International Year of the Nurse and the Midwife 2020 (WHO, 2020c) continues alongside the terrible results of COVID-19 (Rosa et al., 2020). In addition, compared with the general population, health care workers were at greater risk of contracting COVID-19 (Wang, Pan, et al., 2020). They were burdened not just by the increased volume and intensity of their job but also by the ongoing need to adapt to new ways of working (Maben & Bridges, 2020). According to several research, nurses with a high workload were more likely to experience secondary traumatic stress, which reduces job satisfaction and leads to burnout (Niu et al., 2022; Wang, Okoli, et al., 2020). A work overload not only can influence nursing quality and job efficiency but also cause nurses' anxiety, depression and other negative feelings (Niu et al., 2022; Vizheh et al., 2020). In response to a sudden pandemic, medical professionals must address the changing burden of disease and establish new medical or care models, including evolving professional roles and advances in communication and data processing (Weintraub & McKee, 2019). Innovation in health care, as in other industries, is critical to ensure organizational efficiency and effectiveness in a constantly changing health care environment (Weintraub & McKee, 2019; Yang et al., 2019). Prior to the International Year of the Nurse and the Midwife 2020, a report of the World Innovation Summit for Health Nursing and Universal Health Coverage Forum 2018 advocated for redesigning existing services and developing new and innovative services that maximize the contributions of nurses (Crisp et al., 2018). Therefore, research on the innovative behaviours of nurses is necessary and is of great importance to the development of nursing.

Innovative behaviour can be defined as 'intentional generation, promotion, and realization of new ideas within a work role, group, or organization' (Scott & Bruce, 1994). It is widely accepted that innovative behaviour as individual innovation is essential to organizational efficiency (Asurakkody & Shin, 2018; Barr et al., 2021). In the context of nursing, Asurakkody and Shin (2018) defined innovative behaviour as generating new ideas and confidently implementing them, overcoming potential challenges and developing new procedures, treatment strategies or policies to restore and promote the patient's or client's health. Innovative work practices by health care professionals may occur in the form of incremental adaptations to existing health care processes, services or products or in the form of innovative practical solutions (Barr et al., 2021). Health organizations face an increased need for innovation to increase competitiveness and introduce new treatments for patients during the pandemic (Weintraub & McKee, 2019). Improving the innovative behaviour of nurses is an effective measure to reverse the negative aspects of nursing shortage, high nursing workload and pandemic challenges (Catania et al., 2021; Drennan & Ross, 2019; Weintraub & McKee, 2019).

Effective transformational leadership has been identified as an important factor for innovation in successful health care organizations (Kujala et al., 2019). Transformational leadership refers to behaviours of leaders who motivate employees to exceed expected levels of job performance and to implement organizational goals (Bass, 1985). Transformational leadership had a positive effect on patients, professionals and organizations (Ferreira et al., 2022), such as enhanced nurse faculty satisfaction (Boamah, 2022), innovative work behaviour (Masood & Afsar, 2017), employee wellbeing and willingness to stay in the organization (Xie et al., 2020), and reduced burnout (Wu et al., 2020). During the last several decades, transformational leadership has emerged as one of the most effective operational leadership paradigms for 21st century leaders (WHO, 2020a). However, little research has focused on transformational leadership styles in public health emergencies or traumatic event validity of the period. Given the positive impact of transformational leadership on clinical nurses, understanding its impact on nurses' innovative behaviour is important to promote work productivity in the context of the COVID-19 crisis.

Psychological empowerment is a self-efficacy motivational concept, which is determined by the four dimensions of intrinsic motivation for performance tasks: meaning, competence, impact and self-determination (Spreitzer, 1995). Meaning, competence and self-determination refer to the employees' perceived sense of purpose and personal connection to their work, also measuring the extent to which they are confident of being able to perform their tasks, whereas impact measures both the employees' perceived freedom at work and the employees' perceived influence on their department (Spreitzer, 1995). Psychological empowerment has been acknowledged as a means of improving proactive work behaviour (El-Gazar et al., 2022), such as to bolster nursing care quality and job satisfaction (Li et al., 2018). According to previous studies (Liu et al., 2019; Masood & Afsar, 2017), employee psychological empowerment is critical for generating and promoting innovative behaviour among employees. Due to occupational hazards during infection control, isolation and containment, nurses face greater psychological work demands during pandemics (Zhao et al., 2020). Specifically, the impact of psychological empowerment on nurses' innovative behaviour during a pandemic requires further research.

Today, the phenomenon of innovative behaviour has sparked widespread interest in business management (Bai, 2022), technology (Cheng et al., 2021), engineering (Hur & Kim, 2019) and education (Liu et al., 2020). However, there is little discussion of the innovative behaviour of nurses during the pandemic. Therefore, our study described the current state of innovative behaviour among nurses during a pandemic and explored the relationship between transformational leadership, psychological empowerment and innovative behaviour. Our study aimed to inform and to call for the need for nursing managers to focus on the development of innovative behaviours in nurses to improve the efficiency and quality of professional services to support the health care professional workforce through the current pandemic, in preparation for future pandemics.

2 | METHODS

2.1 | Participants

A cross-sectional study of 1317 nurses from 10 hospitals in China was conducted using convenience sampling. The participants were all registered nurses who had to meet the following requirements: (a) hold a Chinese registered nurse licence and (b) work full-time. Nurses who volunteered to participate in the study were asked to sign the informed consent form. The exclusion criteria for nurses were nursing staff who were not directly involved in patient care, such as absent due to sick leave, absent due to personal leave, absent due to study or absent due to further training. According to the Kendall sample estimation method, the sample size of the sample was 5–10 times of the number of variables (Kendall, 1975). Based on the scale with the largest number of items, the calculated sample size was greater than or equal to 130–260 cases ($26 \times 5 - 26 \times 10$). Considering an invalid response rate of 10%, the final calculated sample size was greater than or equal to 143–286 cases ($130 \times 1.1 - 260 \times 1.1$).

2.2 | Survey questionnaire

2.2.1 | Sociodemographic characteristics

Demographic information included gender, age, physical condition, marital status, years of working, education, job title, monthly income and hospital level, whether or not you have a patent, whether or not you have published papers, whether or not you have attended academic conferences, whether or not you have participated in scientific research training and whether or not you have participated in fund research projects.

2.2.2 | Transformational leadership questionnaire

The transformational leadership questionnaire is a multifactor leadership questionnaire developed by Li and Shi (2008) in a Chinese context to examine nurses' perceptions of head nurses' transformational leadership level. There are 26 items containing four dimensions (moral modelling, charisma, articulate vision and individualized consideration). All questionnaire items were scored on a five-point Likert scale from 1 = *strongly disagree* to 5 = *strongly agree*. The questionnaire has a high score of 130 and a low score of 26. The higher the score, the more the head nurse's transformational leadership conduct was perceived by the nurses. The questionnaire's Cronbach's alpha coefficient was .860. Each dimension's Cronbach's α coefficient was .840–.920 (Li & Shi, 2008). In this study, the Cronbach's α coefficient of the scale was .920.

2.2.3 | Psychological Empowerment Questionnaire

The Psychological Empowerment Questionnaire developed by Spreitzer (1995) was modified by Li et al. (2006) according to the

Chinese cultural background. The Psychological Empowerment Questionnaire consisted of 12 items, using a five-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). On a scale of 12 to 60, the higher the score, the greater the psychological empowerment. It included four dimensions: meaning (three items), self-determination (three items), competence (three items) and impact (three items). The Cronbach's α coefficient of each dimension ranged from .790 to .850; it has good reliability and validity. In this study, the Cronbach's α coefficients of the scale was .860.

2.2.4 | Innovative behaviour scale

The Employee Innovative Behavior Scale was developed by Scott and Bruce (1994). Nurses in this study were asked to report whether they engaged and exhibited innovative behaviours at work. It consists of six items and uses a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). The Cronbach's α coefficient for this scale was .935. On a scale of 6 to 30, the higher scores indicate higher levels of innovative behaviour. This study found that the Cronbach's α coefficient of this scale was .912.

2.3 | Data analysis

Descriptive statistics were used to summarize the sociodemographic characteristics of nurses. The statistical analysis was carried out using the IBM SPSS v23.0 software. For all variables, the frequencies and percentages of categorical variables were calculated. The quantitative variables' means (M) and standard deviation (SD) were calculated. A two-sided independent sample t-test and a one-way ANOVA were applied to compare the differences between the continuous variables. Pearson correlation analysis was used to determine the relationship between transformational leadership, psychological empowerment and innovative behaviour. The innovative behaviour scale score was used as a dependent variable, and statistically significant factors identified in the single factor analysis were included in the multiple stepwise regression analysis (calibration level: alpha input = .05, alpha output = .10). A $p < .05$ indicated statistical significance (two-tailed).

3 | RESULTS

3.1 | Demographic characteristics

A total of 1400 questionnaires were distributed, and 1317 valid questionnaires were returned, with a valid rate of 94.07%. The average age of 1317 nurses was 35.16 ± 7.45 years, with 93.62% of them being female. A total of 74.34% of the nurses were married, and the average years of work of nurses was 13.23 ± 8.36 years. Monthly income ($p < .001$) and hospital level ($p = .006$) differed in the mean scores of nurses' innovative behaviour. Among them, 20.65% of nurses had published a patent, 32.5% had published papers, 43.66%

TABLE 1 Differences in general characteristics among nurses ($n = 1317$)

Demographic characteristics	N (%)	Innovative behaviour (M \pm SD)	F/t	p
Gender			.761	.447
Male	84 (6.38%)	4.01 \pm .70		
Female	1233 (93.62%)	3.95 \pm .75		
Age			.728	.573
≤ 25	109 (8.28%)	4.01 \pm .69		
26–30	260 (19.74%)	4.00 \pm .77		
31–35	396 (30.07%)	3.91 \pm .76		
36–40	278 (21.11%)	3.94 \pm .80		
≥ 41	274 (20.80%)	3.96 \pm .69		
Physical condition			10.721	.000***
Very poor	5 (.38%)	3.21 \pm 1.55		
Poor	73 (5.54%)	3.86 \pm .72		
General	575 (43.66%)	3.88 \pm .89		
Better	502 (38.12%)	3.98 \pm .73		
Very good	162 (12.30%)	4.26 \pm .73		
Marital status			.245	.783
Single	306 (23.23%)	3.95 \pm .74		
Married	979 (74.34%)	3.96 \pm .75		
Divorced	32 (2.43%)	3.87 \pm .76		
Years of working			1.055	.348
≤ 10 year	587 (44.57%)	3.98 \pm .74		
11–20years	485 (36.83%)	3.92 \pm .78		
≥ 21 years	245 (18.60%)	3.96 \pm .69		
Education			1.201	.308
Below university	13 (.99%)	3.81 \pm .82		
College	123 (9.34%)	3.92 \pm .78		
Undergraduate	1150 (87.32%)	3.95 \pm .75		
Master's degree and above	31 (2.35%)	4.18 \pm .59		
Job title			.517	.671
Junior nurse	174 (13.21%)	4.01 \pm .78		
Senior nurse	536 (40.70%)	3.95 \pm .76		
Nurse-in-charge	492 (37.36%)	3.93 \pm .75		
Vice-director nurse and above	115 (8.73%)	3.99 \pm .68		
Monthly (RMB)	Income		5.231	.000***
<2000	13 (.99%)	3.58 \pm .87		
2000–4999	315 (23.92%)	3.81 \pm .81		
5000–7999	282 (21.41%)	3.97 \pm .74		
8000–10999	330 (25.06%)	4.01 \pm .74		
≥ 11000	377 (28.63%)	4.04 \pm .67		
Hospital level			5.094	.006**
Grade I	57 (4.33%)	3.65 \pm .90		
Grade II	57 (4.33%)	3.96 \pm .74		
Grade III	1230 (91.34%)	4.01 \pm .77		
Whether or not you have a patent?			3.897	.000***

(Continues)

TABLE 1 (Continued)

Demographic characteristics	N (%)	Innovative behaviour (M ± SD)	F/t	p
Yes	272 (20.65%)	4.11 ± .70		
No	1045 (79.35%)	3.91 ± .76		
Whether or not you have published papers?			3.410	.001**
Yes	428 (32.50%)	4.05 ± .73		
No	889 (67.50%)	3.90 ± .75		
Whether or not you have attended academic conferences?			3.717	.000***
Yes	575 (43.66%)	4.04 ± .73		
No	742 (56.34%)	3.89 ± .76		
Whether or not you have participated in scientific research training?			5.021	.000***
Yes	478 (36.29%)	4.09 ± .72		
No	839 (63.71%)	3.88 ± .76		
Whether or not you have participated in fund research projects?			3.121	.002**
Yes	93 (7.06%)	4.19 ± .72		
No	1224 (92.94%)	3.94 ± .75		

**p < .01.

***p < .001.

TABLE 2 Scales score of study variables and correlation analysis with innovative behaviour scale (n = 1317, M ± SD, r)

Variables	(M ± SD)	r	p
Transformational leadership	4.12 ± .82	.682***	.000
Moral modelling	4.09 ± .88	.643***	.000
Articulate vision	4.12 ± .82	.675***	.000
Individualized consideration	4.11 ± .85	.678***	.000
Charisma	4.17 ± .82	.659***	.000
Psychological empowerment	4.03 ± .64	.756***	.000
Meaning	4.22 ± .74	.686***	.000
Self-determination	4.14 ± .67	.702***	.000
Competence	4.24 ± .65	.700***	.000
Impact	3.71 ± .84	.602***	.000
Innovative behaviour	3.95 ± .75		

***p < .001.

had attended academic conferences, 36.29% had participated in scientific research training and 7.06% had participated in fund research projects. Other sociodemographic and work characteristics are shown in Table 1.

3.2 | Scales score of study variables and correlation analysis with innovative behaviour scale (n = 1317)

The nurses in this study scored 3.95 ± 0.75 for innovative behaviour, 4.12 ± 0.82 for transformational leadership and 4.03 ± 0.64 for

TABLE 3 Variables assignment

Variables	Assignment method
Physical condition	Very poor = 1; poor = 2; general = 3; better = 4; very good = 5
Monthly income	<2000 = 1; 2000–4999 = 2; 5000–7999 = 3; 8000–10999 = 4; ≥11000 = 5
Hospital level	Grade I = 1; Grade II = 2; Grade III = 3
Whether or not you have a patent?	Yes = 0; no = 1
Whether or not you have published papers?	Yes = 0; no = 1
Whether or not you have attended academic conferences?	Yes = 0; no = 1
Whether or not you have participated in scientific research training?	Yes = 0; no = 1
Whether or not you have participated in fund research projects?	Yes = 0; no = 1
Transformational leadership scale	Original value
Psychological empowerment scale	Original value

psychological empowerment. Table 2 provides the mean scores for individual dimensions. In addition, Table 2 shows the results of Pearson correlation analysis of transformational leadership, psychological empowerment and innovative behaviour. The relationships between

variables were all statistically significant. All the facets of transformational leadership and psychological empowerment were positively correlated with innovative behaviour ($p < .01$).

3.3 | Multiple linear regression analysis model of innovative behaviour among nurses

Physical condition, monthly income and hospital level, whether or not you have a patent, whether or not you have published papers, whether or not you have attended academic conferences, whether or not you have participated in scientific research training and whether or not you have participated in fund research projects, as well as the scores of the transformational leadership scale and psychological empowerment scale, were considered independent variables; the innovative behaviour scale score was the dependent variable. The assignment of the variables is shown in Table 3. As shown in Table 4, the covariance diagnosis showed that the tolerance of the model was <1 and the variance inflation factor was <5 , considering that there was no multicollinearity among the independent variables. The results of the multiple linear regression analysis showed that physical condition, whether or not you have attended academic conferences and whether or not you have participated in fund research projects, transformational leadership and psychological empowerment were the main factors on nurses' innovative behaviour ($p < .05$), together explaining 64.5% of the total variance (adjusted $R^2 = .645$).

4 | DISCUSSION

This study was conducted to determine nurses' levels of innovative behaviours and to examine the effects of demographic and

transformational leadership and psychological empowerment on innovative behaviours of nurses working in China. This study shows that transformational leadership and psychological empowerment are important in promoting innovative behaviours among nurses during a pandemic and that the transformational leadership that the participants experienced helped them adapt to changing situations and achieve higher levels of intrinsic motivation through psychological empowerment, which led to psychological satisfaction and the manifestation of innovative behaviours in the workplace.

The results of this study revealed that nurses' innovative behaviour was in medium-high level, which was higher than Weng et al.'s (2015) research and nurses in California (Dy Bunpin et al., 2016). This indicates that China has placed increasing importance on innovative behaviours of nurses in recent years. The ongoing worldwide shortage of nurses and limited medical and health budgets have created a need for hospitals to improve their efficiency, and fostering innovative behaviours in nurses is one way for hospitals to increase the efficiency of their innovation outputs while also being a powerful driver for the development of the nursing discipline (Emiralioglu & Sönmez, 2021; Huang et al., 2021). Despite the pressure of the pandemic, nurses have shown a willingness to innovate and to change their practices. The pandemic changed how nurses worked and interacted with patients and consumers, and it served as a catalyst for nurses to develop new and innovative ways to deliver services (Gardiner & MacLellan, 2022), such that skill mix and staffing models were changed to build capacity in response to the needs of the pandemic (Endacott et al., 2022). In addition, evidence suggests that when people are given the freedom to be curious and innovative, they are more fully engaged in their work, resulting in higher productivity and wellbeing (Raderstorf et al., 2020). Therefore, nurse managers should provide a supportive environment to facilitate nurses' innovative behaviour during the pandemic.

TABLE 4 Multiple linear regression analysis model of innovative behaviour among nurses ($n = 1317$)

Independent variable	B	SE	β	t	P
Constant	.143	.081	-	1.768	.077
Physical condition	.081	.038	.035	2.106	.035*
Whether or not you					
Have attended	.067	.026	.044	2.567	.010*
Academic conferences?					
Whether or not you					
Have participated in	.138	.050	.047	2.734	.006**
Fund research					
Projects?					
Psychological	.617	.026	.528	23.986	.000***
Empowerment					
Transformational leadership	.308	.020	.336	15.504	.000***

Note: $R^2 = .647$, Adjusted $R^2 = .645$; $F = 299.251$, $p = .000$.

Abbreviations: β , standardized coefficient Beta; B, unstandardized coefficient; SE, standard error of B.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Our study showed that transformational leadership positively affects nurse innovative behaviour. The more transformational leadership behaviour is shown by the leader, the more effective it is in stimulating nurse innovative behaviour. This finding agrees with previous studies that transformational leadership is a major factor in promoting employee innovative behaviour (Liu et al., 2019; Masood & Afsar, 2017; Sarıköse & Türkmen, 2020). Studies show that transformational leadership is one of the leadership styles that affect outcomes in health care settings (Ferreira et al., 2022). Transformational leaders may have dampened the negative effects of COVID-19 by creating an inclusive and supportive work environment (Boamah, 2022). Lead-follower interaction and the quality of this relationship are important components of improving innovation in the work environment (Sarıköse & Türkmen, 2020). Our study suggests that transformational leadership may be an effective leadership style for nursing managers, which is important for improving innovative behaviour among nurses during a pandemic. Therefore, nursing managers who are good at applying a transformational leadership style could further promote innovative behaviours among nurses by actively creating an inclusive and supportive work environment, by encouraging employees to think and solve problems innovatively, by promoting the organizational vision and by expressing expectations to nurses and motivating them to improve their intrinsic motivation.

Our research results proved consistent with previous studies that found a positive relationship between psychological empowerment and nurses' innovative behaviour (Liu et al., 2019; Lv et al., 2021; Waheed et al., 2018). Nurses who feel more psychologically empowered would be inclined to demonstrate innovative behaviour in their work. Employees who feel psychologically empowered are more likely to overcome motivational challenges during the innovation process (Schermyly et al., 2014). Better psychological empowerment may result in lower mental pressures and work environmental stressors (Khoshmehr et al., 2020), which was especially important to improve their innovative behaviour during the pandemic outbreak. In these circumstances, psychological empowerment plays a relevant role as a motivational factor. Managers can stimulate intrinsic motivation, can increase interest in work and can exercise innovation in nurses by increasing staff psychological empowerment (Zhang et al., 2022). Therefore, nursing managers should pay attention to nurses' psychological experiences of empowerment, inspire their enthusiasm, guide them to work hard and provide a supportive working environment, thereby increasing their innovative behaviour.

Our study showed that physical condition was an independent influence on nurses' innovative behaviour. This indicates that the better the physical conditions of nurses, the higher the innovative behaviour of nurses. When they are subjected to increased work demands and diminishing resources, they not only experience stress episodes, but they also become more vulnerable to long-term psychological distress during a pandemic (Zhao et al., 2020). Therefore, it is recommended that during a pandemic, nursing managers should not only focus on clinical care but also focus on the physical conditions of nurses, provide nurses with psychological support measures to relax and to release

stress (Chen et al., 2021) and create a favourable work climate that is conducive to promoting innovative behaviours among nurses.

As shown in our study, nurses who have attended academic conferences and fund research projects scored higher on the innovative behaviour scale than those who have not. Nurses who have participated in academic conferences and fund research projects can have a positive clinical and professional impact on them, such as increasing their appreciation for research and their interest in advanced education, as well as meaningful dissemination of findings to improve patient care (Black et al., 2019). Moreover, they acquired more professional knowledge and critical thinking through good training and systematic learning (Chen et al., 2022) and also have access to the latest knowledge through multiple channels (Moehead et al., 2020).

This may encourage their translation of learning into practice, which promotes their innovative behaviours. Therefore, it is recommended that nursing managers also pay attention to the development of innovative behaviours among nurses during the pandemic. By conducting online academic meetings, a blended emergent research training programme (Chen et al., 2022) or nursing innovation training (Huang et al., 2021) and adopting performance incentive mechanisms to encourage nurses to actively join scientific research projects, it helps to bring into play nurses' self-potential and learning initiative and promotes nurses' innovative behaviours, thus meeting the urgent demand for innovative nursing talents and the rapid development of nursing disciplines during the pandemic.

4.1 | Limitations

This study has several limitations that should be acknowledged. To begin with, we used a cross-sectional design, which cannot infer the causal relationships among transformational leadership, psychological empowerment and innovative behaviour. Future research could use a longitudinal design to determine causality. Second, the collected data were self-reported, which could lead to potential subjective and recall bias that could affect the accuracy of the assessment. Third, nurses were recruited from 10 hospitals in China. The applicability of the findings to different regions of China may be limited. It is necessary to investigate whether similar results would be obtained in different organizational or cultural settings. Last but not least, transformational leadership was reported by nurses, which may not entirely reflect the leadership experience of nurse managers. In future research, transformational leadership could be assessed from both nurse perspectives and nurse leader perspectives.

5 | CONCLUSIONS

This cross-sectional study demonstrated the impact of transformational leadership and psychological empowerment on innovative behaviour among nurses during the pandemic. Leadership has always been critical at all levels of the health care system. Similarly, transformational leadership in new treatment approaches and care models is even more

important, especially during a pandemic. Nursing managers should model transformational leadership in their daily work by breaking traditional and outdated care models based on hierarchical and ineffective work teams (Gea-Caballero et al., 2022), especially in these unprecedented times, by creating an inclusive workplace culture that embraces diversity, empowers nurses and improves their innovative behaviour. With the recognition of ongoing workforce shortages and pandemic pressures, these findings have significant implications for nursing managers and society at large. Therefore, evidence-based interventions and strategies to encourage nurse innovation are needed.

6 | IMPLICATIONS FOR NURSING MANAGEMENT

Some implications for nursing management can be summarized from this study. The findings of this study suggest that the innovative behaviour of nurses in China was in medium-high level. Nurse managers and hospital administrators should be aware of the positive impact of innovative behaviour on health care organizations during a pandemic. First, health care organizations need to show institutional commitment to changes in organizational structure, policies and procedures to deal with workload challenges during the ongoing epidemic. These changes should include opportunities for nursing supervisors to receive leadership training. Those in direct supervisory roles should consider learning transformational leadership because it is most likely to be effective, especially in times of uncertainty and chaos (Bass & Riggio, 2000). Given the range of uncertainties associated with COVID-19, transformational leaders must serve as role models and ideal influencers to inspire and to build trust in their followers. Because such leaders are nurse-centred, they will empower nurses, inspire them to think and solve problems innovatively, motivate them to outperform expectations and create a positive work environment, which encourages innovative behaviour among nurses. Second, psychological empowerment is not a personal trait that remains stable in different situations but rather a set of cognitive factors shaped and influenced by the organizational environment (Thomas & Velthouse, 1990). Nursing managers should establish environments that cultivate nurses' empowerment, in which nurses can perceive self-efficacy, autonomy and the impact and meaning of their work, resulting in greater innovation at work. Moreover, nursing managers can establish a resource guarantee system and an information sharing platform, as well as encourage nurses to develop and to implement creative ideas through collaboration. Furthermore, they should advocate for and encourage the sustainability of innovative behaviour by offering ongoing support, rewards and training opportunities.

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Department (FWZR2020004), and the Scientific Research Project of China Medical University's First Hospital (HLB - 2020-01).

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

ETHICAL STATEMENT

The research adhered to the basic norms of clinical ethics. The Ethics Committee of China Medical University's First Affiliated Hospital gave their clearance (approval number: [2020]194), and the hospital administrator granted permission. The subjects took part voluntarily and signed an informed consent form. The research was conducted in accordance with the Helsinki Declaration.

AUTHOR CONTRIBUTIONS

Minyi Zhang and Yan Liu conceptualized and designed the project. Minyi Zhang and Yao Li acquired and managed the data. Minyi Zhang, Hongyu Chen and Ning Wang performed statistical analysis and data analysis. Minyi Zhang, Hongyu Chen and Ning Wang drafted the manuscript. Yan Liu revised the manuscript. Moreover, all authors gave final approval.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available upon reasonable request from the corresponding authors. The data is not publicly available due to privacy or ethical restrictions.

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