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Career adaptability and patient safety culture perceptions among newly graduated oncology nurses: a latent profile analysis

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Abstract

Background Newly graduated nurses in cancer hospitals face significant challenges in high-pressure environments, struggling with career adaptability due to limited clinical experience. This adaptability is crucial for managing occupational stress and influences perceptions of patient safety culture. However, existing studies have not explored this group's latent profiles of career adaptability, underscoring the need for further research.

Objectives This study aims to identify latent profiles of career adaptability among newly graduated nurses in cancer hospitals and examine their impact on perceptions of patient safety culture.

Design This study employed a quantitative, cross-sectional design.

Methods Between October and November 2023, newly graduated nurses from a tertiary cancer hospital in Beijing, China, were recruited through convenience sampling. Data were gathered using a General Information Questionnaire, the Career Adaptability Scale, and the Hospital Survey on Patient Safety Culture Scale. Latent profile analysis was performed using the R3STEP and BCH methods.

Results A total of 365 newly graduated nurses participated. Career adaptability was categorized into three profiles: "low" (14.0%), "moderate" (41.4%), and "high" (44.7%). Significant predictors included age, education level, clinical practice duration, unclear career planning, and lack of tertiary hospital internship experience. Perceptions of patient safety culture varied significantly across the profiles.

Conclusion Career adaptability among newly graduated nurses in cancer hospitals exhibits heterogeneous characteristics that significantly impact their perceptions of patient safety culture. Nursing managers and educators should recognize this diversity and implement individualized strategies to enhance these perceptions.

Keywords Newly graduated nurses, Cancer hospitals, Career adaptability, Hospital survey on patient safety culture, Latent profile analysis

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Introduction

As the global incidence and mortality of cancer continue to rise, oncology nursing is faced with unprecedented challenges [1]. Nurses in cancer hospitals must stay updated with the latest medical advancements and treatment protocols and possess the skills and knowledge necessary to provide effective, safe patient care [2, 3]. This includes managing complex treatments such as chemotherapy, immunotherapy, and surgery and ensuring comprehensive support for patients throughout their treatment. Additionally, nurses must address patients' physical and psychological needs, offering emotional support to patients and their families, and alleviating anxiety, fear, and other negative emotions to improve overall treatment experiences [4].

Newly graduated nurses defined as registered nurses who have been in clinical practice for less than one year [5], are a vital part of the nursing workforce. However, their transition into oncology nursing is particularly challenging. These nurses must quickly adapt to complex clinical environments, heavy workloads, and intense training demands [6]. Moreover, oncology patients often experience severe physical symptoms and psychological distress, which increases the professional stress faced by nurses and can lead to compassion fatigue and moral dilemmas [7, 8]. Studies show that in Asian countries, the intention to leave within the first year among newly graduated nurses can be as high as 60% [9], compared to 33% in Europe [10], highlighting the significant challenges this group faces in terms of career adaptation.

The theory of career adaptability emphasizes an individual's ability to cope with career changes and adapt to new environments [11]. For newly graduated nurses, particularly in the early stages of their careers, a lack of experience and psychological resilience often leads to difficulty in meeting the demands of the job, which can result in decreased job satisfaction and increased turnover rates [12–14]. Therefore, enhancing career adaptability is crucial in helping new nurses navigate the challenges of oncology care, improve job performance, and reduce high turnover [15–17]. Although the importance of career adaptability in newly graduated nurses has gained widespread attention, there is still a lack of research on its heterogeneous characteristics. Latent Profile Analysis (LPA) is an effective tool for identifying different subgroups within this population.

Patient safety is the core of global healthcare services, and establishing a positive safety culture is crucial [18]. Nurses, as the primary caregivers in clinical settings, play a key role in maintaining patient safety, particularly in cancer hospitals where patient conditions are complex, and treatment risks are high [19, 20]. The World Health Organization (WHO) also emphasizes that patient safety was a global priority, with particular significance in oncology care [21]. However, newly graduated nurses face various challenges during their career transition that may affect their perception of patient safety culture. Previous studies have shown that they still require support in areas such as medication management, time management, and clinical decision-making [22]. While the importance of career adaptability in the professional development of new nurses has been widely recognized, most existing researches focus on the impact of factors such as work pressure and teamwork on patient safety culture. There is a lack of research exploring the relationship between career adaptability and patient safety culture perception, particularly in the context of oncology nursing.

This study innovatively applies LPA to identify potential types of career adaptability among newly graduated nurses in cancer hospitals. It aims to explore the relationship between different kinds of career adaptability and their perception of patient safety culture and the influencing factors. The findings will provide a theoretical basis for enhancing career adaptability among new nurses and promoting their positive perception of patient safety culture, thereby better addressing the global challenges in cancer care, improving nursing quality, and ensuring the stability and sustainability of healthcare systems.

The research questions are as follows:

1. Do newly graduated nurses in cancer hospitals experience significant career adaptability challenges, and can they be classified into different latent types based on their adaptability levels?
2. What are the factors influencing different types of career adaptability?
3. How does career adaptability impact the perception of patient safety culture in different types?

Methods

Study design and participants

From October to November 2023, 365 newly graduated nurses from a cancer hospital in Beijing were selected to participate in this study using convenience sampling. Participants included in this study were required to hold a nursing practice license and have completed clinical internship experience. According to Chinese nursing regulations, eligibility for registration as a licensed nurse requires completing at least three years of full-time general nursing or midwifery education, undertaking a minimum of eight months of clinical nursing practice in a teaching or general hospital, and receiving the relevant certification [23]. Additionally, candidates must pass the national nurse practice qualification examination.

The inclusion criteria were as follows: (i) age ≥ 18 years; (ii) clinical nurses who had obtained the registered nurse qualification; (iii) had 12 months of clinical

work experience after obtaining the qualification; and (iv) informed consent and voluntary participation in this study. The exclusion criteria were: (i) nurses visiting for study and clinical practice. Adopting the principle that the sample size should be 5 to 10 times the number of survey entries of the main scale (career adaptability, 24 entries in total) and considering a 15% dropout rate, the required sample size was 138 to 276 cases, which was sufficient for this study.

Survey instruments

To explore the general characteristics of new nurses with low levels of career adaptability, we considered potential sociodemographic factors, including gender, age, education level, family address, only child, clinical practice time (months), career planning, internship experience in tertiary hospitals, whether nursing is the first choice for a career, other hospital training experiences.

Career adaptability

We used the Career Adaptability-Abilities Scale (CAAS) to measure the career adaptability of newly graduated nurses in cancer hospitals. The scale was developed by Savickas et al. [11] in 2012 based on the framework of career adaptability theory. It was Sinicized by Hou et al. [24], and it can be applied to groups with different backgrounds. It consists of four dimensions: concern, control, curiosity, and confidence, with 24 items. A 7-point Likert scale was used, with each entry scored from 1 to 7 on a scale from "completely disagree" to "completely agree". The total score ranged from 24 to 168, with higher scores indicating higher career adaptability. The scale's Cronbach's alpha is 0.989.

Patient safety culture

We used the Hospital Survey on Patient Safety Culture (HSOPSC) to measure newly graduated nurses' perception of the patient safety culture in cancer hospitals. Chinese scholars Li et al. [25]. translated and revised the scale. The questionnaire has 42 items and 12 dimensions. Each item was scored on a 5-point Likert scale, ranging from 1 to 5, from "strongly disagree" to "strongly agree". The dimension scores were the mean scores of the corresponding items, and the total score was the sum of the dimension scores ranging from 12 to 60, with higher scores indicating higher levels of nurses' awareness of the culture of patient safety in hospitals. The scale's Cronbach's alpha is 0.927.

Data collection

The study was approved by the hospital before data collection. The researchers first contacted the nursing management of the cancer hospital and obtained their consent. Questionnaires were distributed and collected using an online survey platform. Participants were informed of the purpose of the study, that their participation was voluntary and anonymous, and that they could withdraw at any time. The researcher then distributed the questionnaire to the teaching WeChat group (a group used for communication and information sharing in teaching), with a 7-day deadline for submission. The first page of the questionnaire was written in consistent language to explain the purpose, methodology, and requirements for completing the survey. Once the questionnaire was developed, it was completed only once per Internet Protocol (IP), and the questions were presented in a page-turning format that took 10 to 15 min to complete. Subjects were able to submit once all questions were answered. At the end of the survey, two researchers examined the questionnaires submitted by the respondents one by one and eliminated those that violated the completion requirements. A total of 384 questionnaires were distributed, 384 questionnaires were returned, and after excluding 19 invalid questionnaires, the number of valid questionnaires was 365, with an effective recovery rate of 95.1%.

Data analysis

Descriptive analysis was conducted using SPSS 24.0. Means and standard deviations were used for descriptive statistics for normally distributed continuous variables. Frequencies and percentages were reported for categorical or ordinal variables. To analyse the career adaptability of newly graduated nurses in cancer hospitals, LPA was performed using Mplus 8.3. The four dimensions of career adaptability were sequentially entered into the LPA model. Initially, a one-profile solution was tested, and the number of profiles was incrementally increased until the optimal solution was identified using maximum likelihood estimation. The model's goodness of fit was assessed through several criteria, including Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), adjusted BIC (aBIC), and entropy. Lower AIC, BIC, and aBIC values indicated better model fit [26]. An entropy value close to one suggests high classification accuracy, and an entropy value ≥ 0.80 indicates that the model's classification accuracy is approximately 90%.

The Lo-Mendell-Rubin test (LMRT) and bootstrap likelihood ratio test (BLRT) were conducted for significance testing, comparing models with M profiles to those with $M+1$ profiles. A significant P-value suggests that the $M+1$ profile model fits the data better than the M-profile model [27]. In determining the optimal number of profiles, statistical indices and substantive interpretation were considered to select the best-fitting model [28].

Furthermore, the R3STEP command in Mplus was used to model the predictors of latent classes. The BCH command was employed to compare the outcome variable

Table 1 General characteristics of participants ($n = 365$)

Variable	Value	Proportion (%)
Gender	Male	35(9.6)
	Female	330(90.4)
Education level	Junior college	158(43.3)
	Top-up Bachelor's Degree Program	56(15.3)
	Bachelor's degree	151(41.4)
Only child	Yes	81(22.2)
	No	284(77.8)
Family address	Local	94(25.8)
	Nonlocal	271(74.2)
Clinical practice time (Months)	8	171(46.8)
	> 8	194(53.2)
Career planning	Yes	343(94.0)
	No	22(6.0)
Internship experience in tertiary hospitals	Yes	356(97.5)
	No	9(2.5)
Whether nursing is the first choice for a career	Yes	355(97.3)
	No	10(2.7)
Other hospital training experiences	Yes	142(38.9)
	No	223(61.1)

patient safety culture across profiles, assessing significant differences in the predicted outcome variables among the different latent profiles.

Ethics statement

The study was conducted in accordance with the principles of the Declaration of Helsinki. It was approved by the approval letter of the Ethics Committee of National Cancer Center/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College (23/313–4005). Informed consent was obtained from all participants, and their participation was voluntary. Additionally, this study was an anonymous survey, did not involve unethical behaviour, and posed no adverse health consequences to participants, either physically or mentally. Clinical trial number: not applicable.

Results

Participant characteristics

A total of 365 nurses participated in the survey. As shown in Table 1, the average age of participants was 23.12 (1.18) years, with 330 (90.4%) females. A total of 151 nurses (41.4%) held bachelor's degrees. Additionally, 271 nurses (74.2%) were from nonlocal, and 284 (77.8%) were not the only child in their family. A total of 194 nurses (53.2%) had more than eight months of clinical practice experience, and 356 (97.5%) had completed their clinical practice in tertiary hospitals, with 223 nurses.

(61.1%) having additional training experiences in other hospitals. Furthermore, 343 nurses (94.0%) reported precise career planning, and 355 (97.3%) stated that nursing was their first career choice.

Latent profile analysis

LPA was conducted on the career adaptability of 365 newly graduated nurses in cancer hospitals by sequentially constructing models with one to five latent profiles. The optimal solution was the 3-profile model based on a comprehensive evaluation of the latent profile indicators, as shown in Table 2. The reasons are as follows: (1) When the number of latent profiles increased from one to three, the BIC value decreased significantly, and both the LMR and BLRT tests were statistically significant ($P < 0.001$). (2) The entropy value exceeded 0.80, indicating that the model's classification accuracy was approximately 90%. (3) In the 4-profile model, the smallest profile represented only 3.5% of the sample, suggesting that this profile had low representativeness. Therefore, considering all fit indices and clinical relevance, the 3-profile model was selected as the optimal solution. The average posterior probabilities for each profile were calculated to verify the reliability of the LPA result. The average membership probabilities for the three profiles ranged from 0.989 to 0.998, indicating that the 3-profile model was a reliable fit for the data [29].

Naming of latent profiles

The total score for career adaptability among the 365 newly graduated nurses was 149.04 (18.08). The mean scores for the four dimensions of concern, control,

Table 2 Latent profile model fit indices

Model	Loglikelihood	AIC	BIC	aBIC	Entropy	LMR LR *p*-value	BLRT *p*-value	Probabilities of classes(%)
1-profile	-4331.896	8679.792	8710.991	8685.610	*NA*	*NA*	*NA*	100
2-profile	-3877.351	7780.701	7831.400	7790.156	0.933	0.006	< 0.001	51.8/48.2
3-profile	-3346.359	6728.718	6798.916	6741.809	0.981	< 0.001	< 0.001	14.0/41.4/44.7
4-profile	-3132.035	6310.070	6399.768	6326.798	0.988	0.001	< 0.001	3.5/12.7/44.4/39.4
5-profile	-3043.002	6142.004	6251.201	6162.368	0.989	0.065	< 0.001	3.3/12.6/35.6/6.3/42.2

Note: AIC stands for Akaike Information Criterion, BIC stands for Bayesian Information Criterion, aBIC stands for adjusted Bayesian Information Criterion, Entropy refers to the measure of classification accuracy, LMR refers to the Lo-Mendell-Rubin likelihood ratio test, and BLRT stands for Bootstrap Likelihood Ratio Test

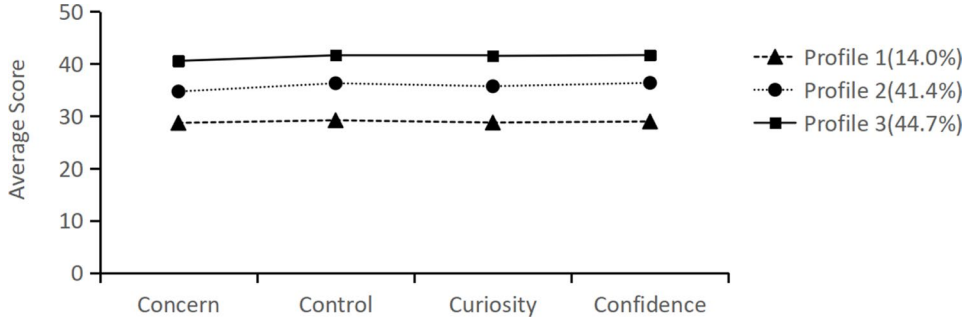

Fig. 1 Latent profile characteristics of career adaptability. Note: Profile 1 = "low career adaptability group," Profile 2 = "moderate career adaptability group," Profile 3 = "high career adaptability group."

Table 3 Three-step results for antecedents (R3STEP)

Profile comparison	Value	Profile 1 VS Profile 3	Profile 2 VS Profile 3	Profile 1 VS Profile 2
Age, year		-1.082*	-0.544	-0.538
Gender	Male (Ref.)			
	Female	-0.121	-0.196	0.075
Education level	Junior college (Ref.)			
	Top-up Bachelor's Degree Program	1.010	0.997*	0.014
	Bachelor's degree	0.556	0.641*	-0.084
Only child	Yes (Ref.)			
	No	-0.086	-0.436	0.350
Family address	Local (Ref.)			
	Nonlocal	-0.441	0.084	-0.525
Clinical practice time (Months)	8 (Ref.)			
	> 8	-0.376	-0.822*	0.446
Career planning	Yes (Ref.)			
	No	1.701*	0.165	1.536*
Internship experience in tertiary hospitals	Yes (Ref.)			
	No	-17.475**	-0.703	-16.772**
Whether nursing is the first choice for a career	Yes (Ref.)			
	No	0.911	-0.358	1.268
Other hospital training experiences	Yes (Ref.)			
	No	-0.073	-0.443	0.370

Note: Profile 1 = "low career adaptability group," Profile 2 = "moderate career adaptability group," Profile 3 = "high career adaptability group," *$p < 0.05$, **$p < 0.01$

curiosity, and confidence were 36.44 (4.92), 37.65 (4.62), 37.29 (4.67), and 37.66 (4.64), respectively. Figure 1 illustrates the response probabilities for these four dimensions across the three latent profiles of newly graduated nurses in cancer hospitals. Based on the characteristics of each profile, the following names were assigned: (1) Profile 1: Nurses in this profile had low probability values across all four dimensions of career adaptability and were named the "low career adaptability group," comprising 51 nurses (14.0%). (2) Profile 2: Nurses in this profile had higher probability values in all four dimensions compared to Profile 1, indicating a moderate level of career adaptability. The profile was named the "moderate career adaptability group," including 151 nurses (41.4%), the most significant proportion. (3) Profile 3: Nurses in this profile had the highest probability values across all four dimensions and were named the "high career adaptability group," consisting of 163 nurses (44.7%).

Predictor variables

In this study, the LPA combined with the robust R3STEP was used to analyse the antecedents affecting the career adaptability profiles of newly graduated nurses. The main findings are presented in Table 3. Compared to the "high career adaptability group," the "low career adaptability group" was significantly younger ($p < 0.05$). This indicates that older, newly graduated nurses are more likely to exhibit higher career adaptability. Additionally, freshly graduated nurses without precise career planning were more likely to belong to the "low career adaptability

Table 4 The impact of different latent profiles of career adaptability on newly graduated nurses' perceptions of patient safety culture

Profiles	M(SE)	BCHχ^2	Difference between profiles
Profile 1	138.765 (1.990)	265.187**	3 > 2 > 1
Profile 2	166.127 (1.791)		
Profile 3	180.710 (1.647)		

Note: Profile 1 = "low career adaptability group," Profile 2 = "moderate career adaptability group," Profile 3 = "high career adaptability group," $^{**}p < 0.01$

group" ($p < 0.05$), and there were also significant differences between the low and moderate career adaptability groups ($p < 0.05$). These findings suggest that career planning significantly impacts the career adaptability of newly graduated nurses.

In addition, significant differences were observed in education levels between the "moderate career adaptability group" and the "high career adaptability group," with top-up bachelor's degree program and bachelor's degree showing a significant difference ($p < 0.05$). This suggests that higher educational attainment positively influences career adaptability. Newly graduated nurses with longer internship durations (more than eight months) showed significant differences between the "low career adaptability group" ($p < 0.05$), indicating that a more extended internship period may be associated with higher career adaptability.

Compared to newly graduated nurses who had internships in tertiary hospitals, those without such experience were likelier to belong to the "high career adaptability group." This difference was significant between the low and high career adaptability groups ($p < 0.01$) and between the low and moderate career adaptability groups ($p < 0.01$). This suggests that internship experience in tertiary hospitals significantly impacts newly graduated nurses' career adaptability.

Outcome variables

As shown in Table 4, there are significant differences in patient safety culture perception across the different latent profiles of career adaptability. Specifically, nurses in the "high career adaptability group" demonstrated the highest perception of patient safety culture. Nurses in the "moderate career adaptability group" had a higher perception of patient safety culture than those in the "low career adaptability group."

Discussion

To the best of our knowledge, this is the first study to examine the latent profiles of career adaptability among newly graduated nurses working in cancer hospitals. The findings identified three distinct profiles of career adaptability and further investigated their influencing factors, with a particular focus on career planning, education level, and internship experience. Additionally, the study highlighted significant differences in the perception of patient safety culture among nurses with varying career adaptability profiles.

The study found that older nurses and those with higher education (such as an top-up bachelor's degree program or bachelor's degree) were more likely to have higher career adaptability. Older nurses typically possess more life experience and professional maturity, enabling them to cope better with workplace challenges [30]. At the same time, higher education provides nurses with a solid foundation of professional knowledge, critical thinking, problem-solving skills, and leadership abilities, all of which enhance their career adaptability [31]. Based on these findings, managers should recognize the significant impact of age and education level on the career adaptability of newly graduated nurses and adopt appropriate support strategies. For younger nurses, nursing management departments can arrange for experienced nurses to provide regular one-on-one guidance and feedback, helping them build confidence and gradually improve their ability to handle complex work situations. Additionally, encouraging newly graduated nurses to pursue higher education or attend career-related training courses can be a long-term strategy to enhance career adaptability.

This study also examined the potential influence of being an "only child" as a contributing factor. Within the context of China's sociocultural dynamics, only child often face unique family expectations and responsibilities, which may shape their psychological resilience and workplace adaptability [32]. However, the analysis revealed no significant association between the "only child" variable and the latent profile categories of career adaptability in this sample. This suggests that while family structure may influence individual traits, its direct impact on career adaptability remains unclear and warrants further investigation in future studies. Understanding this relationship could offer valuable insights for developing targeted interventions.

Career planning has also been a critical factor influencing career adaptability. This study shows that newly graduated nurses who need precise career planning are more likely to be categorized in the low career adaptability group. Career planning involves personal development and organizational support [33]. Effective career planning provides nurses with a clear career development pathway, enhancing their work motivation and engagement, reducing turnover tendencies, improving the quality of nursing services, and ultimately strengthening career identity and adaptability [33, 34]. Based on these findings, nursing education institutions should develop systematic and scientifically sound career planning courses to help newly graduated nurses define their career goals and establish long-term career visions while

still in school. Meanwhile, clinical instructors should actively analyze the professional environment in which freshly graduated nurses operate, offer adaptive guidance, and assist them in developing feasible career development plans that align with their ability levels.

The length of the internship is also closely related to career adaptability. This study found that newly graduated nurses with longer clinical practice time (over eight months) were likelier belong to the high adaptability group. This indicates that extended clinical practice time helps newly graduated nurses better familiarize themselves with and adapt to the work environment, significantly enhancing their career adaptability [33, 35]. Therefore, hospitals and nursing education institutions should consider extending the duration of internships when designing internship programs and ensure the diversity and richness of internship content to cultivate professional interest and strengthen resilience to face future career challenges [36]. Optimizing the internship experience can effectively promote the professional growth of newly graduated nurses, thereby improving the overall quality of care.

Notably, this study found that newly graduated nurses without internship experience in tertiary hospitals exhibited higher career adaptability than those who had interned in tertiary hospitals. This result may reflect the high workload, complex clinical environment, and standardized teaching tasks in tertiary hospitals, where personalized support might be limited, thus affecting nurses' career adaptability [37, 38]. This finding suggests that, while tertiary hospitals provide valuable clinical experience, managers should pay greater attention to offering psychological support and fostering adaptability in newly graduated nurses to mitigate the negative impact of high-pressure environments on their career development [39].

Patient safety culture refers to the collective attitudes, beliefs, values, and behaviours among healthcare professionals within a medical institution aimed at achieving patient safety [40]. Studies have shown that the higher a nurse's awareness of patient safety culture, the more proactive their safety behaviours are, thereby reducing the incidence of adverse events [41, 42]. For newly graduated nurses working in cancer hospitals, their lack of clinical experience in oncology nursing, insufficient knowledge, unfamiliarity with skills, and limited interpersonal abilities pose challenges to their career adaptability and understanding of patient safety culture, especially during the early stages of their careers [12].

This study found that career adaptability profiles significantly influence newly graduated nurses' perception of patient safety culture. Nurses with high career adaptability tend to have a more comprehensive understanding of patient safety culture. This may be attributed to their enhanced psychological resilience and adaptability, which equip them to handle the high-stress demands of oncology nursing more effectively. As a result, they are more aware of safety practices and actively engage in behaviours that promote patient safety [35]. In contrast, nurses with low career adaptability often find it challenging to adapt to the intense pressures of oncology care. These challenges can impede their ability to fully perceive and implement patient safety culture, potentially affecting the quality and safety of care they provide [43].

Therefore, hospital managers should develop personalized training programs based on newly graduated nurses' specific needs and adaptability levels. These programs should include essential nursing skills, communication techniques, and knowledge of oncology nursing. Additionally, setting up psychological counselling and support groups can help newly graduated nurses cope with work-related stress and enhance their psychological resilience. Creating a safety culture environment and regularly conducting safety training sessions will also be crucial. Through these comprehensive measures, hospital managers can effectively improve the career adaptability of newly graduated nurses, strengthen their awareness and execution of patient safety culture, and ultimately enhance the quality of care and patient safety.

Implications for clinical practice

The findings of this study provide new directions for formulating nursing and healthcare policies. First, hospital managers and nursing education institutions should recognize the critical role that career adaptability plays in newly graduated nurses' professional performance and their perception of patient safety culture. Based on this, it is recommended that personalized support for newly graduated nurses at the policy level be strengthened, including regular mental health counselling, career planning training, and the extension and optimization of clinical internships. These measures help to enhance nurses' career adaptability and directly improve their understanding and implementation of patient safety culture, thereby reducing medical errors and improving the quality of patient care.

Limitations

Despite providing valuable insights into the career adaptability of newly graduated nurses in cancer hospitals, this study has several limitations. First, the cross-sectional design limits the ability to infer causality. Second, the sample was drawn exclusively from cancer hospitals, which may reduce the generalizability of the findings to nurses in other fields. Finally, the measurement of career adaptability was based on self-reported data, which may be influenced by social desirability bias. Future research should incorporate multiple assessment tools to obtain more comprehensive results.

Conclusion

This study is the first to explore the latent profiles of career adaptability among newly graduated nurses in cancer hospitals. It reveals three adaptability profiles and their influencing factors, particularly the role of education level, internship experience, and career planning. The findings indicate that different levels of career adaptability significantly affect nurses' perception of patient safety culture, with those showing higher adaptability demonstrating more vital patient safety awareness. Therefore, enhancing newly graduated nurses' career adaptability is an important strategy for fostering their professional development and an effective means to improve the patient safety culture. Based on these findings, nursing managers and policymakers should focus on the personalized needs of newly graduated nurses, developing targeted interventions to enhance their career adaptability and awareness of patient safety culture, ultimately improving the overall quality of care and patient safety.

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Author contributions
F.M. planned the study and wrote and revised the paper. Y.L. contributed to dissertation guidance. F.M., M.L. and Y.Z. contributed to the performed statistical analysis. L.L. and H.C. make tables and figures. W.W., Y.Z. and H.C. were involved in data collection. Y.L. and F.Z. were responsible for reviewing and revising the manuscript.

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Data availability
Data will be available upon reasonable request from the corresponding author.

Declarations

Ethics approval and consent to participate
The study was conducted in accordance with the principles of the Declaration of Helsinki. It was approved by the approval letter of the Ethics Committee of National Cancer Center/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College (23/313–4005). Informed consent was obtained from all participants, and their participation was voluntary. Additionally, this study was an anonymous survey, did not involve unethical behaviour, and posed no adverse health consequences to participants, either physically or mentally.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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