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Influence of information anxiety on core competency of registered nurses: mediating effect of digital health literacy

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Abstract

Background In the information age of health care, nurses often face information overload, leading to negative emotions, e.g., anxiety that may impede the adoption of evidence-based practice and clinical decision-making process. Nurses with higher digital health literacy can effectively process and manage information. Despite this, no research has explored the relationship between information anxiety, digital health literacy, and core competency among nurses. Therefore, this study aims to investigate the mediating effects of digital health literacy on information anxiety and core competency among nurses.

Methods From July to October 2023, the data for this cross-sectional study were collected. The study surveyed a total of 608 nurses from three tertiary hospitals in Fujian Province, and the survey instruments included a sociodemographic information questionnaire, Chinese revision version of the Digital Health Literacy Instrument (CR-DHLI), Information Anxiety Scale (IAS), and Competency Inventory for Registered Nurses (CIRN). Descriptive statistics and Pearson correlation analysis were conducted using SPSS 29.0, and the mediating effect of digital health literacy was examined using Mplus.

Results The mean score of nurses' information anxiety, digital health literacy, and core competency was 3.03 ± 0.91, 2.46 ± 0.56, 2.72 ± 0.88, respectively. And the mediation model of information anxiety on core competency for nurses showed a good model fit index (χ^2/df = 2.207, CFI = 0.985, TLI = 0.982, RMSEA = 0.045, SRMR = 0.035). Digital health literacy was positively correlated with nurses' core competency but negatively correlated with information anxiety. The results of path analysis revealed that information anxiety had negative and significant direct effects on NCC (β = -0.119, P = 0.004) and DHL (β = -0.297, P < 0.001). DHL had a positive effect on NCC (β = 0.306, P < 0.001). Digital health literacy played a partial mediating role, accounting for 43.54% of the relationship between information anxiety and nurses' core competency.

Conclusions Information anxiety among nurses was at relatively high levels, which had a negative impact on the core competency of nurses. This issue requires attention from nursing managers. The mediating role of digital health literacy in the relationship between information anxiety and core competency among nurses has been established.

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Nursing managers should strengthen the evaluation of nurses' DHL and devise effective support strategies to enhance DHL, thus improving the core competence of nurses in information age.

Keywords Information anxiety, Information overload, Digital health literacy, Core competency, Nurse

Background

Advances in information and communication technologies (ICTs) have accelerated the digitization of health care fields [1]. ICTs refer to all communication technologies, including the internet, wireless networks, computers, video-conferencing, social networking, and other media applications and services for which enabling users to access, retrieve, store, transmit, and manipulate information in a digital form, etc. [2]. The evolution of health care from the "face-to-face age" to the "information age" has been profoundly influenced by the emergence of ICTs [3]. The impact of ICTs on the nursing practice is being recognized by nurses [4]. The use of ICTs is not only for transmitting information but also for supporting self-care and offering benefits in tracking chronic disease patients [5–7]. The digital transformation of healthcare is giving new vitality to improving the quality of care and health outcomes [8]. Nurses must adjust to this new context to remain relevant and effective, this requires a shift in the epistemology of professional nursing to recognize the digital environment in which care is provided [9]. There is increased attention to nurses' core competency (NCC) in complex digital health care setting.

Core competency of registered nurses

The core competency of registered nurses refers to the professional ability shown in the completion of nursing works, including knowledge, skills, attitudes, values and other comprehensive abilities [10, 11]. NCC is a holistic and dynamically evolving competency, involves the integration of multiple abilities in response to changes in society, healthcare environments, and the nursing profession [12]. Liu et al. [10, 13] developed the Competency Inventory for Registered Nurses (CIRN) in China based on International Council of Nurses (ICN) Framework of Competencies for the Generalist Nurse proposed by the ICN. This framework includes competencies in clinical care, leadership, interpersonal relationship, legal/ethical practice, professional development, teaching-coaching, critical thinking/research aptitude [10, 13]. In this study, NCC signifies the application of knowledge, skills, and attitudes by nurses in clinical practice, enabling individuals to effectively perform a range of tasks and adhere to appropriate standards to adapt to the continuously evolving social, medical environment, and nursing profession [12]. The process of digitization will result in substantial alterations to the roles and duties of the healthcare personnel, hence underscoring the necessity for capacity building and continuous professional development [14]. Digital technologies are increasingly being employed in the healthcare sector, offering new avenues for nurses to care for patients, conduct research and education, track diseases, and monitor public health [3, 9, 15]. When integrated with clinical practices and tailored to fit these practices, ICTs can be effectively utilized, transforming the internet into a convenient digital information resource for busy nursing professionals [16, 17]. This supports the professional development of healthcare personnel [18]. And previous study [19] indicate that proficient users of ICTs exhibit higher nursing abilities compared to those with lower ICTs skills. In essence, ICTs empowers nurses to enhance their core competencies by leveraging technology to improve patient care, streamline operations, foster collaboration, and advance professional development within the rapidly evolving healthcare landscape. The abilities to generate, send, and process information are recognized as practical skills influencing nursing capacity in such a digital healthcare environment [20]. This implies that the ability to gather, process and send information as well as other skills relating to ICT, exert an influence on nursing competency [19]. Therefore, when nurses encounter difficulties and uncertainties while using ICTs, they are prone to negative emotions [21], which may affect their core competencies.

Information anxiety

Individuals may experience anxiety when they come to the realization that they lack the ability to comprehend perceived information [22, 23]. Wurman proposed that "Information anxiety is produced by the ever-widening gap between what we understand and what we think we should understand" [24]. The information generated within the healthcare sector, as well as information pertaining to healthcare, has experienced exponential growth with the advent of the World Wide Web (www) and online communication [22]. Registered nurses hold a distinctively crucial role in the provision of medical services, to stay current with professional advancements and navigate the swiftly evolving, multifaceted realm of medical practice, they consistently require access to information to supplement their knowledge and clinical experience [25, 26]. However, accessing and processing a vast amount of information within a limited time frame can prove burdensome and stressful, leading to information overload [27]. The increase in health information technology is supposed to improve nursing quality, efficiency, and safety. However, information overload in electronic health records has been shown to detract

from the ease of use of the system, contribute to stress and burnout among healthcare professionals, worsen workloads, and create opportunities for errors [28–30]. Previous studies [31, 32] pointed out that when faced with a health crisis such as COVID-19, it generated a deluge of information [33, 34], which impeded nurses' ability to process the information accurately leading to subpar decision-making. The information on the internet is complex, chaotic and of varying quality, while users have a strong psychological reaction to the reliability of information, inaccurate or duplicated information often compels nurses to spend a significant amount of time collecting and utilizing data, leading to they have strong irritability and anxiety. Persistent exposure to anxiety may have adverse effects on their behavior patterns, psychological states and work performance [35–37]. It has been shown that although a certain level of anxiety can be beneficial for motivating and arousing enthusiasm in an individual, unmanaged anxiety can have long-term consequences on the work performance and job satisfaction of nurses [38, 39]. Earlier study [40] have found that when nurses are uncertain about the relevance, accuracy, or effective application of information, or when they feel overwhelmed by the volume and complexity of research evidence, the information overload or anxiety can impede evidence-based practice (EBP) and clinical decision-making in the context of nursing.

Digital health literacy

Previous study [41] has shown that digital health literacy (DHL) contributes to alleviating the adverse consequences (e.g., information anxiety) of the infodemic (an infodemic is too much information including false or misleading information, in digital and physical environments during a disease outbreak [42]). DHL, refers to "the ability to search, select, appraise, and apply online health information and health care-related digital applications" [43, 44]. Studies [45–47] have shown that high DHL contributes to nurses' ability to effectively navigating the healthcare system web-based for information retrieval and decision-making, enabling them to accurately comprehend and utilize essential data to enhance nursing competency and medical service. DHL has evolved into an essential skill for health professionals, enabling them to find accurate and reliable health information online, improved skill development is probably going originate from valuable medical internet research chances that foster critical thinking [48, 49], ensuring that individuals are optimally making use of available digital health access. Poor digital health literates might suffer more from information overload. Indeed, study has underlined the significance of strengthening DHL level to cope with information overload [50]. Previous study [51] showed DHL can mitigate the heightened psychological distress elicited by the infodemic. Furthermore, Kim et al. [52] found that online misinformation leads to misunderstandings regardless of DHL levels. However, individuals with higher DHL are better equipped to verify and correct these misunderstandings, making them less likely to act on them. This indicates that DHL is crucial for helping individuals navigate environments with information overload.

Theoretical framework and research hypotheses

The hypothesized model (Fig. 1) of this study was derived from the Transactional Model of eHealth Literacy (TMeHL) developed by Paige [53]. TMeHL highlights the role of DHL in empowering individuals and facilitating informed decision-making. This is particularly relevant for nurses who need to be adept at using digital health information to make critical clinical decisions and provide patient care. TMeHL assumes that contextual factors affecting DHL were divided into task-oriented and user-oriented factors. The interaction of these factors produces different degrees and types of noise factors, which hinder or promote the successful interaction of online health information [53]. However, the opposite association exists between DHL and the detrimental impact of noise. And greater DHL levels counteracts the adverse effects of noise generated by digital health contextual factors and facilitates a favorable digital health experience and translational (application) competency [53]. In this study, the proposed conceptual model consists of three concepts: (1) the noise refers to information anxiety, including cognitive or information overload due to a wide variety of multimedia or physical challenges with the technology used or the affective response to the eHealth experience, including the urgency of the information or the nature of the search. (2) DHL, a multidimensional and hierarchical individual skill, as conceptualized by TMeHL. (3) Informed and empowered: the capacity of an informed and engaged user to apply knowledge gained from a digital health transaction across diverse socioecological factors will ultimately inform users' future digital health motivation and perceived usefulness for addressing a particular health concern. For nurses, this empowerment refer to effective patient care, clinical decision-making, and professional development. According to the TMeHL, DHL mediates the relationship between the effect of noise on digital health contextual factors and the degree to which a digital health end user is informed and empowered. Based on the model, we hypothesized that DHL may play a mediating role between information anxiety and core competency. Therefore, based on previous studies and TMeHL, we constructed a research model with information anxiety as the independent variable, NCC as the dependent

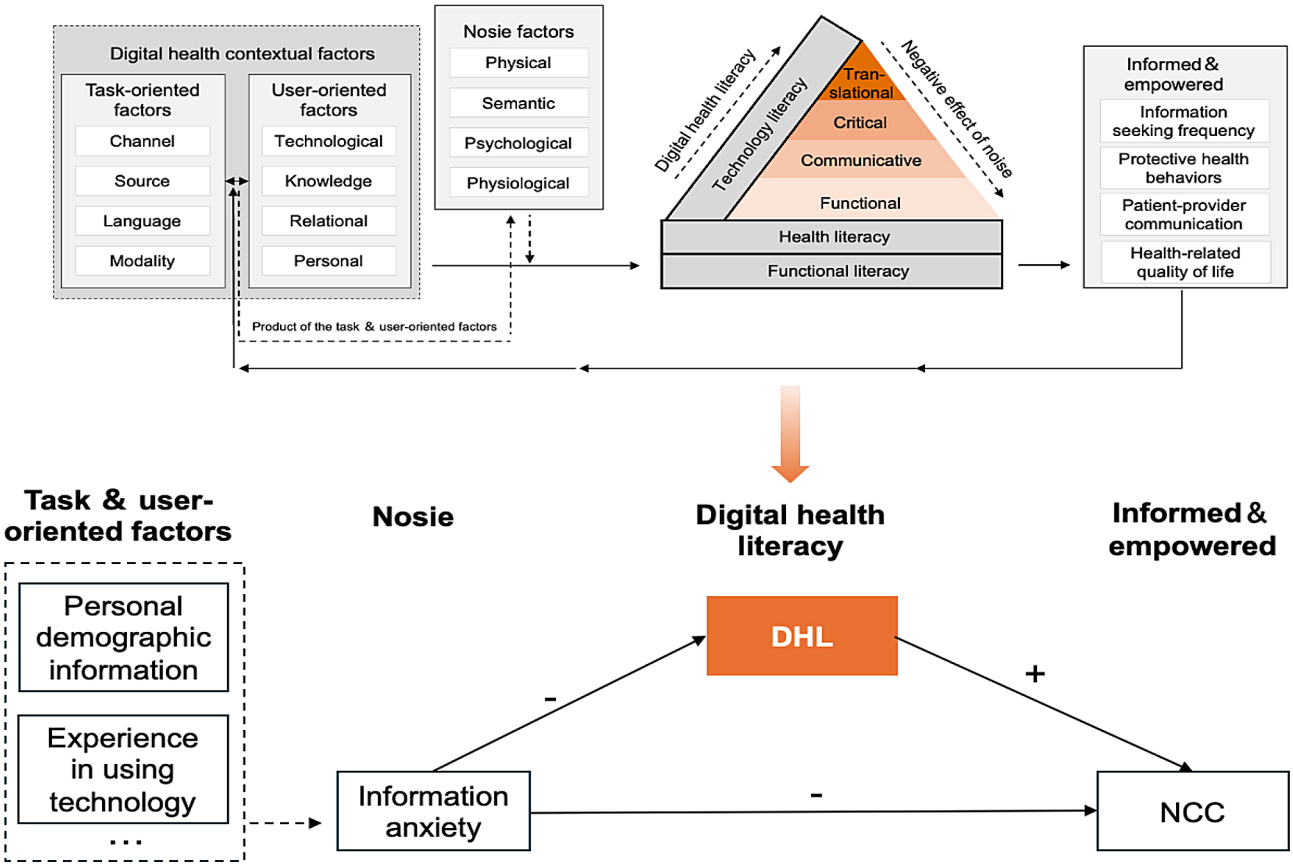

Fig. 1 The hypothesized model for this study. *Note DHL* digital health literacy; *NCC* nurses' core competency

variable, and DHL as mediating variable (Fig. 1). We proposed the following three hypotheses:

Hypothesis 1 information anxiety is significantly and negatively related to NCC.

Hypothesis 2 DHL is significantly and positively related to NCC.

Hypothesis 3 DHL mediates the relationship between information anxiety and NCC.

The purpose of this study was to investigate the correlation between information anxiety and NCC, and investigate the mediating role of DHL in this relationship in particular. To the best of our knowledge, this study is the first to examine the relationship between DHL, information anxiety, and NCC. This study provides valuable insights into how information anxiety affect nursing performance and the role that digital health literacy plays in this relationship. By understanding these dynamics, nursing managers can implement targeted interventions, training programs, and policies that enhance nurses' competencies, reduce anxiety, and ultimately improve patient care.

Methods

Study design and participants

A cross-sectional survey was conducted in Fujian Province, China. From July to October 2023, eligible nurses from the 3 selected tertiary hospitals located in Western Fujian (Longyan), Central Fujian (Fuzhou), and Southern Fujian (Quanzhou) were included using convenience sampling. Inclusion criteria were: (a) being a registered nurse and being employed at the hospital; and (b) volunteering to participate in the study. The exclusion criteria were as follows: (a) work less than 6 months; (b) absence due to illness, maternity, or other personal reasons for more than 6 months. The relationship between information anxiety, DHL, and NCC was analyzed using a structural equation model (SEM), requiring a minimum of 200 samples to run the model, as suggested by Shah and Goldstein [54]. And the suggested empirical power tables based on study by Fritz and Mackinnon [55], a sample size of 558 or greater is required for 0.8 power when using the percentile bootstrap to test the mediating effect [56]. A total of 656 nurses completed and returned the surveys. However, 48 questionnaires were disqualified due to irregular responses and were excluded from the overall analysis. As a result, 608 nurses participated in the study, with a response rate of 92.68%.

Measurement

Four tools were used to collect data and analyze the variables of this study:

1. Socio-demographic characteristics

Socio-demographic information collected included age, gender, educational background, years of nursing experience, professional title, working position (general nurse, clinical nursing teachers, nursing team leader, head nurse), average monthly earnings (CNY), form of employment (contract nurses or official nurses), official nurses are hired for a job position to work stably and continuously, covered by the social insurance system of health care institutions, with good benefits than contract nurses in China [57].

2. Digital health literacy instrument (DHLI)

The DHLI [44] was used to assess DHL. The DHLI was developed by van der Vaart and Drossaert [44] and translated into Chinese version (CR-DHLI) by Zhao et al [58]. CR-DHLI is comprised of 7 subscales: (1) operational skills; (2) navigation skills; (3) information searching; (4) determining relevance; (5) evaluating reliability; (6) adding self-generated context; (7) protecting privacy and 7 performance-based items [44, 58]. Each self-reported item was scored on a Likert 5-point scale with scores ranging from 0 (very difficult) to 4 (very easy) and 0 (never) to 4 (often), each performance-based item has 4–5 answer options, of which 1 is correct, correct answer receives 1 point, accumulating a maximum of 7 points in total. The mean of subscales was used to calculate DHL total score, the higher the score, the greater the DHL. The validity and reliability of the CR-DHLI was approved, the Cronbach's alpha coefficient was calculated to be 0.929 in the study of Zhao et al [58]. In this study, the Cronbach's alpha was 0.947.

3. Information anxiety scale (IAS)

To access information anxiety, the IAS was used [59], It consists of 30 items. Each item response is rate on Likert 5-point scale with scores ranging from 1 (strongly disagree) to 5 (strongly agree). It has 6 subscales: (1) information quality anxiety; (2) information quantity anxiety; (3) information retrieval tool anxiety; (4) information literacy anxiety; (5) information acquisition anxiety; and (6) information processing anxiety. An increased score signifies a more severe degree of information anxiety. Cronbach's alpha coefficient of IAS in the original study was calculated to be 0.972 [59]. In the present study, the Cronbach's alpha value was 0.984.

4. Competency inventory for registered nurses (CIRN)

Nurse's core competency was accessed by the CIRN [10]. It consists of 55 items. Each item response is rate on Likert 5-point scale with scores ranging from 0 (not competent at all) to 4 (very competent). It has 7 subscales: (1) clinical care; (2) leadership; (3) interpersonal relationship; (4) legal/ethical practice; (5) professional development; (6) teaching-coaching; (7) critical thinking/research aptitude [10]. A higher score corresponds to a greater NCC. The Cronbach's alpha coefficient for this scale has been in the range of 0.90 to 0.97 in current studies [10, 60, 61], and it has been psychometrically evaluated and implemented in different countries. The Cronbach's alpha value was 0.988.

Data collection

The data for the study were gathered via an online questionnaire survey platform (accessible at www.wjx.cn), utilizing an innominate, self-reported questionnaire. Initially, we contacted three hospital administrators in Fujian province via WeChat, requesting their assistance in distributing the web-based survey link to their nurse staff who met the criteria. With the cooperation of nursing managers, the questionnaires were successfully distributed to the nurses. Participants were acquainted about the purpose, significance, and precautions of the survey process. Those who voluntarily chose to take part in the study completed the questionnaire by either clicking on the provided link on WeChat or scanning the QR code. To ensure the completeness and validity of the questionnaire, we adhered to unified guidelines, designated all questions as mandatory, restricted each IP address to one submission only, and established a minimum cumulative answer time of 200 s. One week before the survey, the primary researcher provided training to other worker. These trained researchers were responsible for collecting the online questionnaires and monitoring the quality of responses throughout the process. In the event of any issues, researchers communicated with the nursing managers of each hospital for resolution.

Data analysis

Data were analyzed using IBM SPSS Statistics 29.0 software and Mplus version 8.0. Normally distributed continuous variables were expressed as the mean and standard deviations (SD), nonnormally distributed continuous variables were presented as the median and interquartile range (IQR). The relationship among information anxiety, DHL, and NCC was verified using the Pearson correlation test. The mediating effect of DHL in the relationship between information anxiety and NCC was estimated using the structural equation modeling method implemented in Mplus 8.0. The covariance matrix of

relevant variables was evaluated by maximum likelihood (ML) estimation. We applied 5,000 samples for bootstrap resampling and a 95% confidence interval (CI) to examine the direct and indirect effects between information anxiety, DHL, and NCC. To assess the model fit, the following criteria were used: $\chi^2/df < 3$, comparative fit index (CFI) > 0.9, Tucker–Lewis index (TLI) > 0.90, standardized root mean square residual (SRMR) < 0.08, and root mean square error of approximation (RMSEA) < 0.08 [62]. The statistical significance was set at $P < 0.05$, with two-tailed testing.

Results

General characteristics of the participants and scores for each scale

A total of 608 registered nurses were included in this study. Table 1 shows the general characteristics of the surveyed nurses. Most nurses were female. The age of the nurses ranged from 20 to 54 years (mean ± SD: 32.06 ± 7.19), and median time of nursing experience was 10 (Q1 5, Q3 13; range 0.7–35 years). Half of the nurses had a bachelor's degree or above. More than half of the nurses had an average monthly income of more than 5,000 yuan. The mean scores of nurses' information anxiety, DHL, and NCC were 3.03 ± 0.91, 2.46 ± 0.56, 2.72 ± 0.88, respectively.

The correlation of variables

As shown in Table 2, Pearson's correlation coefficient showed that there was a negative correlation between the score of information anxiety and NCC (r = -0.200, $P < 0.001$) and DHL (r = -0.303, $P < 0.001$). The NCC score ($r = 0.333$, $P < 0.001$) was significantly positively correlated with the DHL scores.

Mediating role of DHL on information anxiety and NCC

A path analysis was performed to estimate the direct and indirect impacts of both DHL and information anxiety on NCC among nurses (Fig. 2). NCC was considered as the dependent variable, information anxiety as the independent variable, and DHL as the mediating variable. A structural equation model was constructed based on theoretical framework and previous studies. The findings

Table 1 Participants' characteristics and differences in core competency, digital health literacy, and information anxiety ($N = 608$)

Variables	*N*	(%)	NCC		DHL		Information anxiety	
			Mean	SD	Mean	SD	Mean	SD
Gender								
Male	30	4.9	2.91	0.92	2.62	0.72	2.95	0.83
Female	578	95.1	2.72	0.88	2.45	0.55	3.03	0.92
Age (years)								
20–25	121	19.9	2.78	0.82	2.48	0.56	3.00	0.96
26–30	105	17.3	2.64	0.95	2.42	0.59	2.96	0.80
31–39	288	47.4	2.72	0.88	2.47	0.55	3.05	0.92
≥ 40	94	15.5	2.77	0.91	2.44	0.58	3.08	0.97
Education level								
Less than a bachelor's degree	299	49.2	2.71	0.86	2.43	0.56	2.99	0.90
Bachelor's degree	301	49.5	2.74	0.92	2.48	0.57	3.06	0.92
Master's degree and above	8	1.3	2.93	0.38	2.51	0.51	3.15	1.01
Professional title								
Nurse	133	21.9	2.75	0.84	2.43	0.57	2.99	0.89
Senior nurse	245	40.3	2.71	0.89	2.48	0.57	3.01	0.90
Nurse supervisor or above	230	37.8	2.73	0.90	2.45	0.55	3.08	0.94
Working position								
General nurse	422	69.4	2.73	0.88	2.46	0.55	2.99	0.92
Clinical nursing teachers	146	24.0	2.64	0.92	2.45	0.59	3.14	0.84
Nursing team leader or above	40	6.6	2.98	0.77	2.47	0.58	3.04	1.04
Form of employment								
Contract nurse	374	61.5	2.70	0.88	2.46	0.57	2.99	0.91
Official nurses	234	38.5	2.76	0.88	2.45	0.54	3.09	0.92
Average monthly earnings (RMB)								
< 5000	102	16.8	2.75	0.81	2.54	0.55	3.02	0.94
5000 ~ 7999	374	61.5	2.70	0.90	2.43	0.58	2.99	0.89
8000 ~ 11,999	117	19.2	2.77	0.92	2.45	0.51	3.13	0.92
≥ 12,000	15	2.5	2.86	0.65	2.60	0.56	3.27	1.17

Table 2 Correlation between nurse's core competency, digital health literacy, and information anxiety

Variables	1	2	3	4	5	6	7	8	9	10
1. CC	--									
2. LS	0.763**	--								
3. IR	0.797**	0.844**	--							
4. LP	0.729**	0.752**	0.851**	--						
5. PRO	0.741**	0.758**	0.831**	0.803**	--					
6. TC	0.721**	0.732**	0.812**	0.801**	0.871**	--				
7. CR	0.680**	0.742**	0.791**	0.801**	0.820**	0.843**	--			
8. NCC	0.869**	0.893**	0.939**	0.908**	0.911**	0.903**	0.895**	--		
9. DHL	0.290**	0.261**	0.334**	0.302**	0.338**	0.306**	0.287**	0.333**	--	
10. INA	-0.134**	-0.184**	-0.209**	-0.134**	-0.213**	-0.198**	-0.208**	-0.200**	-0.303**	--

Note ** $P<0.001$

Abbreviations CC clinical care; *LS* leadership; *IR* interpersonal relationship; *LP* legal/ethical practice; *PRO* professional development; *TC* teaching-coaching; *CR* critical thinking/research aptitude *DHL* digital health literacy; *NCC* nurses' core competency; *INA* information anxiety

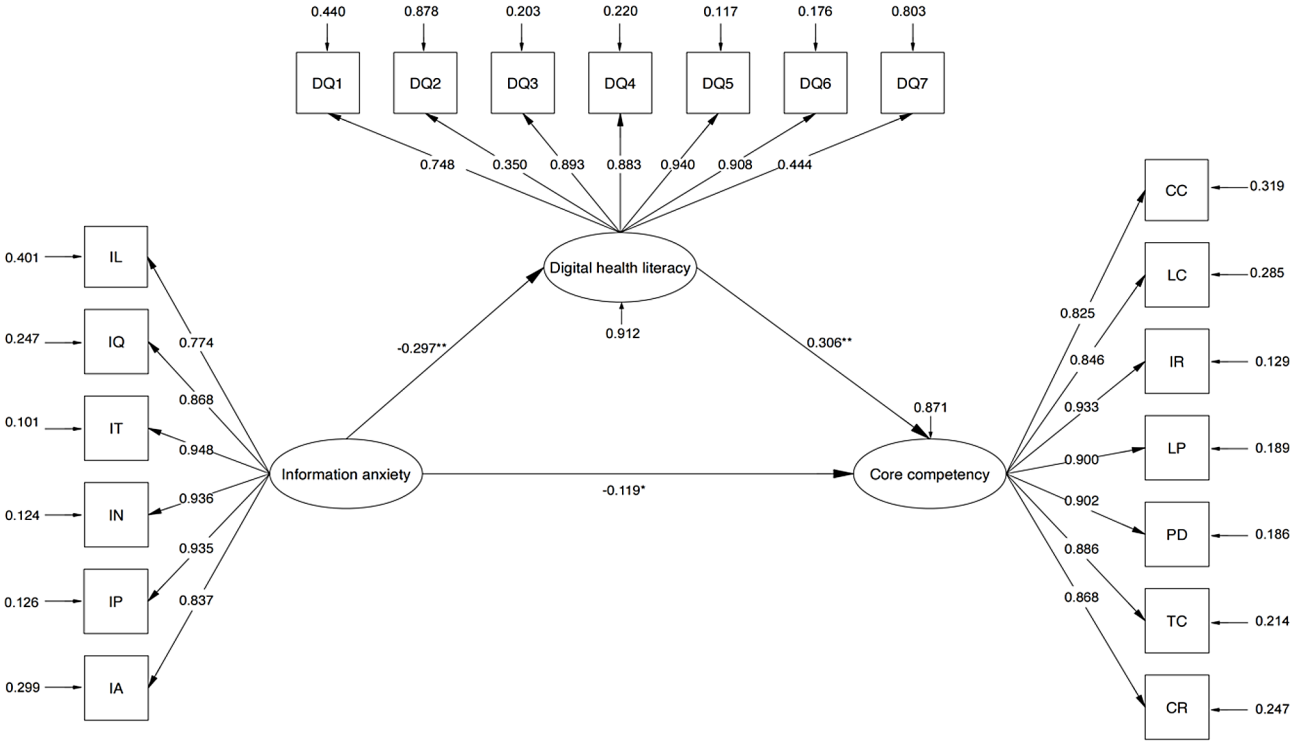

Fig. 2 The structural model of this study. *Note* *$P<0.05$, *$P<0.001$; *IL* information literacy anxiety; *IQ* information quality anxiety; *IT* information retrieval tool anxiety; *IN* information quantity anxiety; *IP* information processing Anxiety; *IA* information acquisition anxiety, *CC* clinical care; *LC* leadership; *IR* interpersonal relationship; *LP* legal/ethical practice; *PD* professional development; *TC* teaching-coaching; *CR* critical thinking/research aptitude. *DQ1* operational skills; *DQ2* navigation skills; *DQ3* information searching; *DQ4* determining relevance; *DQ5* evaluating reliability; *DQ6* adding self-generated context; *DQ7* protecting privacy

Table 3 Model fitting standard and fitting index of the model

	χ^2/df	RMSEA	TFI	CFI	SRMR
Model fitting standard	< 3	< 0.08	> 0.9	> 0.9	< 0.08
Model fitting index	2.207	0.045	0.982	0.985	0.035

indicated a good fit between the model and the data (Table 3).

As shown in Fig. 2, information anxiety could negatively predict DHL (β = –0.297, $P<0.001$) and NCC (β = -0.119, $P<0.05$), DHL could positively predict NCC (β=0.306, $P<0.001$). Further, DHL partially mediated the relationship between information anxiety and NCC, and the total mediating effect was 0.091, the total effect was 0.209 (Table 4). The results of the Bootstrap mediating effect test showed that the mediation effect accounted for 43.54% of the total effect.

Table 4 Standardized direct, indirect, and total effects of the hypothesized model

Effects		*β*	SE	*t*-value	Percentile 95% CI		*P* value
					Lower	Upper	
Direct effects	INA → CIRN	-0.119	0.040	-2.942	-0.185	-0.052	**0.004**
Indirect effects	INA → DHL → CIRN	-0.091	0.019	-4.852	-0.121	-0.060	**<0.001**
Total effects	CIRN → INA	-0.209	0.039	-5.432	-0.273	-0.146	**<0.001**

Note Standardized estimating of 5,000 bootstrap samples. *CIRN* core competency of registered nurse; *DHL* digital health literacy; *INA* information anxiety; *bold* Statistically significant differences

Discussion

This study aimed to determine whether DHL mediates the association between information anxiety and NCC in Chinese registered nurses. First, the findings revealed that information anxiety had an adverse impact on NCC among registered nurses. Second, DHL was positively correlated with NCC. Third, DHL played a mediating role in the association between information anxiety and NCC in registered nurses. Our findings substantiate the hypotheses we posited initially.

Relationship between information anxiety and core competency of nurses

As for the relationship between information anxiety and NCC in registered nurses, the study has identified a correlation between a severe degree of information anxiety and lower NCC. The ability to locate relevant information to guide clinical practice is crucial for high-quality nursing care and patient safety [63]. However, nurses report the following challenges in clinical practice when it comes to addressing clinical issues, especially in locating the most relevant evidence, identifying appropriate sources, adopting effective search methods, and critically evaluating evidence [64]. When mixed messages and information overload occurred, they may have caused confusion and affected the psychological health of nurses [32, 33]. Maharaj et al. [65] believed that poor mental health among nurses could have a negative impact not just on the individual but also on professional performance and, consequently, on the quality of patient care. Relevant studies [66, 67] also showed that feelings like anxiety may have debilitating effects that reduce work output and clinical decision-making ability of nurses, ultimately, leading to debilitating NCC. This result emphasizes that nursing leaders should identify symptoms of anxiety in nurses early and provide customized support and additional services when using digital health technologies.

Relationship between digital health literacy and core competency of nurses

Furthermore, this study found a positive relationship between DHL and NCC, and DHL demonstrated a positive and direct predictive effect on NCC ($\beta=0.306$, $P<0.001$). This indicates that higher DHL scores among nurses were correlated with more positive performance in their core competencies. NCC is the key to ensuring the provision of high-quality nursing care [68]. This competency encompasses a range of attributes, including knowledge, skills, talents, and personal characteristics, which collectively empower nurses to execute tasks effectively [12]. As society and the healthcare environment continue to change and digital technologies increasingly affect nursing practice, the evolving nature of NCC becomes apparent. The growing demand underscores the importance of capacity building and ongoing professional development [12, 69]. Study [70] has shown that high DHL was pivotal for nurses to adapt to the digital transformation of healthcare. Nurses with better skills and knowledge necessary to use online health resources would be more actively engaged in overall health-promoting behaviors and self-improvement [71]. Previous study [46] found that individuals with high DHL levels were generally better at solving health problems and promoting healthy behaviors compared to those with low DHL levels. This means that nursing staff with higher DHL levels tend to exhibit better nursing performance and capabilities.

The mediating role of digital health literacy in the relationship between information anxiety and core competency of nurses

This study revealed that the partially mediating role of DHL in the association between information anxiety and NCC. This means that when nurses are overwhelmed by information and accompanying anxiety, which compromises NCC, nevertheless, augmenting nurses' DHL mitigates this impact. This finding is consistent with Tell [53], which holds that DHL mediates the relationship between the effect of noise on digital health contextual factors and the extent to which an end user is informed and empowered [53]. In other terms, greater DHL negates the adverse effects of noise triggered by digital health contextual factors and promotes a positive digital health experience [53]. The digital transformation in the healthcare industry has also increased the demand for enhancing the digital capabilities of current and future healthcare professionals [72]. For nurses, mastering the skills of identifying and processing information in stressful and demanding clinical work is a significant challenge

[73]. The vast amount of information could potentially lead to information overload for them, which in turn might make them feel overwhelmed and anxious, there was considerable concern that such circumstances had the potential to impact nurses' nursing practice abilities [31, 74]. However, nurses with advanced DHL can efficiently obtain, identify, and utilize internet resources to address practical clinical challenges [46, 47]. Our findings are consistent with a previous study [75], which revealed that higher DHL was associated with greater information satisfaction, leading to reduced anxiety levels. It's worth noting that this study was conducted with student population. DHL will be indispensable for both healthcare providers and patients, playing a crucial role in enhancing the quality of nursing and patient outcomes [76]. Therefore, nursing managers should prioritize identifying and mitigating information anxiety in nursing practice, alongside devising long-term educational strategies and initiatives geared towards bolstering nurses' DHL. Nurses are encouraged to harness internet resources fully, engage in active search, discovery, comprehension, and pursue evidence-based solutions for complex nursing issues. This proactive approach aims to strengthen the application of critical thinking and core competencies [75], enabling the delivery of superior nursing services to patients.

Limitations

Several limitations are included in this study. First, the evaluation of NCC is currently based on self-reported, which may produce bias. Future research could explore alternative methods such as peer evaluation or performance indicators for a more objective assessment. Second, the recruitment of nurses from only three tertiary hospitals located in a single province, restricts the applicability of the study's results to other regions and populations. To enhance comprehension of the correlation between information anxiety, DHL, and NCC among nurses, it is advisable to expand the sample size and ascertain variations across regional scales.

Conclusions

We found that information anxiety negatively impacted the NCC, and DHL partially mediated this relationship in this cross-sectional study. DHL, as a critical asset in the digital health workplace, mitigates the effects of information anxiety on NCC in the digital era. In response to the digital transformation of the health sector, nurses have expanded their scope of activity through this innovative process. Therefore, nursing managers should strengthen the evaluation of nurses' DHL and devise effective support strategies to enhance DHL, thus improving the NCC.

Abbreviations

CR-DHLI	Chinese revision version of the Digital Health Literacy Instrument
IAS	Information Anxiety Scale
CIRN	Competency Inventory for Registered Nurses
ICTs	Information and communication technologies
NCC	Nurses' core competency
DHL	Digital health literacy
TMeHL	Transactional Model of eHealth Literacy
SEM	Structural equation modeling
SD	Standard deviations
IQR	Interquartile range
ML	Maximum likelihood
CI	Confidence interval
CFI	Comparative fit index
TLI	Tucker–Lewis index
SRMR	Standardized root mean square residual
RMSEA	Root mean square error of approximation

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Author contributions

Zhao contributed to analysis and interpretation of the data and writing of the original draft manuscript. Chen assisted in the distribution and collection of questionnaires and the compilation and analysis of data. Yan participated in interpretation of the results and provided critical review of the paper. Lin and Li supervised the project and contributed to the design of the study, the revision, and the review of the final.

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Data availability

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by Ethical Committee of Fujian Medical University (2023/107). Prior to data collection, the researcher explained the purpose and procedures of the study to the participants, including that confidentiality was assured and participation in the study was voluntary. Obtained informed consent from all participants, the eligible nurses had the right to withdraw from the study at any time. The information gathered was kept confidential.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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