Predictors of nurses' caring practice for critically ill patients in critical technological environments: A cross-sectional survey study

Yinglan Li and Waraporn Kongsuwan*

Abstract

Background: Caring practice for critically ill patients refers to the actions/behaviors/performance of nurses while caring for critically ill adult patients in the intensive care unit (ICU). Although the caring practice is vital in ICUs and complex due to the multitude of available technologies, research on ICU nurses' caring practice and its predictive factors are lacking.

Objective: This study aimed to explore the level of nurses' caring practice for critically ill patients in critical technological environments in China and its predictors.

Methods: This was a cross-sectional online survey study with 218 ICU nurses in 29 tertiary hospitals of Guizhou province, China, from 1st to 30th April 2020. Data were collected by using e-questionnaires made in the Questionnaire Star program, including the Demographic Data Questionnaire (DDQ), Practice of Technological Competency as Caring in Nursing Instrument (P-TCCNI), Influence of Technology Questionnaire (ITQ), and Nurses' Professional Value Scale (NPVS). The questionnaires were content validated by three experts. Cronbach's alpha coefficient was 0.96 for the P-TCCNI, 0.70 for the ITQ, and 0.95 for the NPVS. Links to the questionnaires were distributed by research assistants to WeChat groups including target participants. Statistical Package for the Social Science (SPSS) program version 26 (IBM Corporation, Armonk, NY, USA) was used for data analysis. Descriptive and inferential statistics were used to analyze the data. Multiple linear regression analysis using stepwise solution analysis was performed to identify unique predictors of nurses' caring practice.

Results: The level of nurses' caring practice for critically ill patients was high (mean = 87.30, standard deviation = 13.73). The professional value was a significant predictor of nurses' caring practice (β = 0.41, p = 0.00).

Conclusion: ICU nurses exhibited a high level of caring practice. Professional value was a significant predictor of ICU nurses' caring practice. Nursing administrators should understand the current situation of caring practice in critical technological environments and design strategies to maintain and improve ICU nurses' professional value to increase the level of caring practice.

Keywords

caring practice; critically ill patient; critical technological environments; ICU; nursing; China

Caring practice in critical technological environments such as ICUs is dynamic and complex due to the numerous technologies used to treat patients' serious conditions. It is widely believed that technologies can reduce nurses' workload and thereby provide nurses with more time to communicate with patients and meet their emotional needs (Sabzevari et al., 2015). However, in the real situation of caring practice, technologies can distract nurses from getting to know their patients and providing appropriate care (Locsin & Kongsuwan, 2018). It was found that nurses often use their time to manage and resolve problems with new and advanced technologies, and this increases nurses' feelings of stress and uncertainty and decreases their attention on caring for patients (Kongsuwan & Locsin,

Faculty of Nursing, Prince of Songkla University, Hat Yai, Songkhla, Thailand

Corresponding author:
Waraporn Kongsuwan, PhD, RN
Faculty of Nursing, Prince of Songkla University, Hat Yai, Songkhla, Thailand 90112
Telephone: +66-74-28-6522 Fax: +66-74-28-6421
E-mail: waraporn.k@psu.ac.th; waraporn_kongsuwan@yahoo.co.uk

2011; Locsin & Kongsuwan, 2013). To improve this situation, nurses are required to maintain excellent technological competency, cultivate a deep understanding of their patients, and provide the best caring practice for their patients (Despins, 2017; Locsin & Kongsuwan, 2018; Petersen et al., 2019).

Nursing researchers have consistently viewed caring as a vital constituent of nursing in their studies (Su et al., 2014; Wang et al., 2014; Cheng et al., 2017). However, the findings of these studies indicated caring for critically ill patients among ICU nurses was inadequate. Compared to general wards, ICUs are 'closed' units where patients are in round-the-clock care by intensivists, especially bedside nurses (Kisorio & Langley, 2019). Hence, ICU nurses' caring practice plays an essential role in intensive care nursing. However, a study in Nepal showed that ICU nurses were short of technological competency in caring for critically ill patients (Limbu et al., 2019). Additionally, a study in Japan demonstrated that nurses' recognition of caring for patients was higher than their actual practice (Kato, Miyagawa, et al., 2017).

Technology, caring, and competency are key aspects of caring practice in ICU nursing, which differs from caring practice in other medical areas (Locsin, 2005). Locsin developed the theory of Technological Competency as Caring in Nursing (TCCN), which focuses on caring in technological environments in ICUs (Locsin, 2005). In this theory, technology and caring are understood as co-existing in nursing practice, and caring is expressed through technological competency used by experts to know a patient as a whole at the moment (Locsin, 2005). To measure technological competency as caring in technological environments, the Technological Competency as Caring in Nursing Instrument (TCCNI) was developed (Parcells & Locsin, 2011). It was used by Biswas et al. (2016) in Bangladesh to survey the ICU nurses' perception of caring. Later, it was modified by Kato, Miyagawa, et al. (2017) to the Perceived Inventory of Technological Competency as Caring in Nursing (PITCCN). When Kato et al. used the PITCCN to survey ICU nurses, they found ICU nurses' recognition of caring was higher than their practice of caring ($p < 0.01$) (Kato, Tanioka, et al., 2017).

There are several factors proven to be related to nurses' caring practice in ICUs, namely age (Enns & Sawatzky, 2016; Yau et al., 2019), work experience (Reid et al., 2018; Yau et al., 2019), education level (Yau et al., 2019), and professional value (Hu, 2017; Poorchangizi et al., 2019; Tehranineshat et al., 2020). In China, professional value is the key influencing factor of nursing practice that guides decision-making and nursing behaviors. It was defined as one conviction that makes people believe they can achieve the goal in their career, and it is the key to satisfying inner needs and unlocking the achievement in individuals' activities (Fang et al., 2013). Several studies showed that older nurses had a higher level of caring ability and caring behaviors (Wu et al., 2019; Yau et al., 2019). In a study, Yau et al. (2019) reported that work experience was

associated with nurses' caring behaviors. Meanwhile, older nurses' caring practice was higher than younger nurses (Kato, Miyagawa, et al., 2017). Moreover, nurses with a higher education level had a higher level of caring behaviors (Yau et al., 2019). Hu (2017) indicated that a significant association exists between caring ability and professional value.

However, these factors were proved to be associated with one aspect of caring practice, such as caring recognition, caring ability, caring perception, caring capacity, or caring behavior. Limited studies have explored predictors of caring practice for critically ill patients among ICU nurses. It is necessary to better understand the impact of influencing factors on ICU nurses' caring practice and use this knowledge to improve nurses' caring practice. Therefore, this study aimed to explore the level of nurses' caring practice for critically ill patients in critical technological environments and its predictors.

Theoretical Framework
The conceptual framework of this study is developed based on the theory of TCCN and a literature review of factors associated with caring practice in ICUs. The theory of TCCN is a middle-range theory developed by Locsin (2005), which is grounded in Boykin and Schoenhofer (2001)'s theory of Nursing as Caring. The essential goal of this theory is knowing a patient as a whole by using technological competency as a process of knowing in nursing practice (Locsin, 2005). The theory of TCCN views technology and caring as coexisting in nursing practice. Five assumptions of this theory are described as follows: 1) Persons are caring by virtue of their humanness (Boykin & Schoenhofer, 2001); 2) The ideal of wholeness is a perspective of unity (Locsin, 2005); 3) Knowing persons is a multidimensional process (Locsin, 2005); 4) Technologies of health and nursing are elements for caring (Locsin, 2005); and 5) Nursing as a discipline and professional practice (Boykin & Schoenhofer, 2001).

By the literature review, some factors are known to be associated with the caring practice. Therefore, the selected factors for caring practice prediction in this study include nurses' age, work experience, educational level, the influence of technology, and professional value.

Methods

Study Design
A cross-sectional online survey study was conducted from 1st to 30th April 2020.

Sample and Setting
This study was conducted among ICU nurses in 29 tertiary hospitals of Guizhou province China. In China, hospitals are divided into three grades based on ability and number of beds (Wang et al., 2016). Tertiary hospitals, the highest-level hospitals, have more than 500 beds and are responsible for providing more specialist health services,

education, and research. In addition, since tertiary hospitals have a larger number of and more categories of advanced technologies (Wang et al., 2016), nurses who work in tertiary hospitals face greater technology-based pressure than those who work in secondary hospitals. Hence, the data were collected from seven types of ICUs (respiratory, emergency, general, neurological, surgical, medical, and cardiological units) in tertiary hospitals.

The participants were nurses who worked in the ICUs of tertiary hospitals in Guizhou province, China. A convenient sampling technique was used for data collection. Several nurses were invited to assist with the study. If they accepted the invitation, they were enrolled in the study as research assistants responsible for distributing the link to the questionnaire to target ICU nurses' WeChat groups. The inclusion criteria of participants were: 1) being a registered nurse, 2) working in an adult ICU, and 3) being willing to participate in the study. The exclusion criteria were ICU nurses who were not responsible for bedside nursing, such as chief nurses or administrative nurses.

The sample size was determined by power analysis (Polit & Beck, 2017). The significance level (α) of 0.05, power of 0.80, and average effect size of 0.20 were used to analyze the sample size. The required minimum sample size was 194. However, the response rate of the internet-based survey was about 33% (Lindemann, 2019). To overcome the anticipated low response rate, the sample size was increased by 67% to 588. The response rate in this study was 40.31%, meaning the number of participants who replied to questionnaires was 237. Finally, after deleting invalid questionnaires, a total of 218 participants were included.

Instruments

There were four parts in the questionnaire pack, including the Demographic Data Questionnaire (DDQ), Practice of Technological Competency as Caring in Nursing Instrument (P-TCCNI), Influence of Technology Questionnaire (ITQ), and Nurses' Professional Values Scale (NPVS). The permissions for utilizing, modifying some items (if necessary), and translating the questionnaires were obtained from the original authors. The content validity of the scales was tested with three nursing experts, and the item-level content validity (I-CVI) indexes of P-TCCNI, ITQ, and NPVS were 1 (after a series of revisions), 0.94, and 0.95, respectively. A pilot study was used to examine the reliability of three instruments with 30 ICU nurses. A back translation technique was used to translate the P-TCCNI and ITQ from English to Chinese (Polit & Beck, 2012).

The DDQ was used to collect demographic data, including age, gender, religion, work experience, education level, work overload, continuing education and training, and unit.

The P-TCCNI was used to evaluate the level of nurses' caring practice for critically ill patients in technological environments. It was modified from the TCCNI, an instrument developed by Parcells and Locsin (2011) based

on the theory of TCCN (Locsin, 2005). The P-TCCNI is a 5-point Likert scale questionnaire (ranging from 1 = never practice to 5 = always practice). There are 22 items categorized into five sub-scales based on the five assumptions of the theory of TCCN. The overall score range is 22–110. A higher mean score indicates a higher level of caring practice, and total mean scores are divided into three levels: low (22–51.33), moderate (51.34–80.66), and high (80.67–110) (Grove et al., 2013). The level of each item is interpreted into three levels: low (1.0–2.33), moderate (2.34–3.66), and high (3.67–5.00). Cronbach's alpha coefficient of the P-TCCNI is 0.96.

The ITQ was designed to assess the influence of technology on nursing care according to the nurses' beliefs (Bagherian et al., 2017). It is a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree) developed by Sabzevari et al. (2015) and consisting of a total of 22 items, with both negative (13 items) and positive (9 items) subscales. The total score ranges from 22 to 110. After reversing the negative items, a higher score indicates a higher level of influence of technology. The Cronbach's alpha coefficient is 0.70.

The NPVS, including 17 items in three dimensions (behavior value, personal value, and social value), was designed by Deng et al. (2012) to assess the degree of professional value in the Chinese context. The score ranges from 17 to 85, with a higher score indicating a higher level of professional value. Each item is measured on a 5-point Likert scale, where 1 = never meet and 5 = always meet. The Cronbach's alpha coefficient is 0.95.

Data Collection

Data were collected from 1st to 30th April 2020. After consultation with three experts who each had the clinical experience of more than ten years (one chief nurse of RICU and two professors of Faculty of Nursing) and completion of a pilot study to test the revised instruments, the final questionnaires were used to collect data. The e-questionnaires were created in Questionnaire Star, an application program widely used by researchers to create and distribute six types of instruments.

Once the research assistants distributed the link to the questionnaire to participants via WeChat, participants could open the link in the WeChat group without registration. The survey took approximately 20–30 minutes, and participants could finish it at their convenience within one week. Data were collected from Questionnaire Star directly. A total of 351 participants did not complete the questionnaires. Of the 237 completed questionnaires, 19 were invalid because of obvious logic contradictions, providing the same answers to all questions or marking "0" for work experience. The remaining 218 questionnaires were included in the data analysis.

Data Analysis

Statistical Package for the Social Sciences (SPSS) program version 26 (IBM Corporation, Armonk, NY, USA)

was used for data analysis. The demographic data and the level of nurses' caring practice were analyzed by descriptive statistics, including frequency, percentage, mean (M), range, and standard deviation (SD). To examine the predictors of nurses' caring practice, multiple linear regression analysis was carried out. The stepwise selection was used to choose the final regression model. Prior to performing multiple linear regression analysis, the assumptions of normality, linearity, homoscedasticity, and multicollinearity were tested to ensure the accuracy of the findings and ensure no violation of statistical assumptions. The dependent variable was the total score of P-TCCNI. The independent variables were age, work experience, education level, the influence of technology, and professional value. The statistically significant level was set at $p < 0.05$.

Ethical Consideration
This study was approved by the Social and Behavioral Sciences Institutional Review Board (IRB), Prince of Songkla University, Thailand (IRB No. 2019-NSt 024). An implied informed consent form was provided to participants during data collection. Participants had the right to withdraw without prejudice at any time. The original data were kept confidential and maintained for five years after data analysis.

Results

Participant Characteristics
The demographic characteristics of participants are presented in **Table 1**. The age of participants ranged from 21 to 48 years, and the mean age was 29.58 (SD = 4.52). The majority of participants were female ($n = 164$, 75.2%), and 62.9% ($n = 139$) were married. More than 80% ($n = 175$) of respondents had no religion. Their work experience in the ICU and nursing (years) ranged from 0.1 to 17 and 0.5 to 28, respectively. Additionally, 27.7% of participants ($n = 62$) had a diploma degree, 69.6% ($n = 150$) had a bachelor's degree, and 84.4% ($n = 184$) reported they had received continuing education and training on concepts related to caring for critically ill patients and technology. Furthermore, 64.7% of participants ($n = 141$) felt they had work overload in their shifts.

Table 1 Demographic characteristics ($N = 218$)

Demographic data	Frequency (n)	Percentage (%)
Age (years)		
(Min = 21, Max = 48, M = 29.58, SD = 4.52)		
21–30	133	61.0
31–40	82	37.6
41–48	3	1.4
Gender		
Female	164	75.2
Male	54	24.8
Marital status		
Married	139	63.8
Unmarried	76	34.9
Divorced	3	1.4
Religion		
No religion	175	80.3
Buddhist	41	18.8
Christian	2	0.9
Work experience in ICU (years)		
(Min = 0.1, Max = 17, M = 4.99, SD = 3.72)		
≤5	135	61.9
6–10	67	30.7
11–15	14	6.4
16–17	2	0.9
Work experience in nursing (years)		
(Min = 0.5, Max = 28, M = 6.65, SD = 4.59)		
≤5	111	50.9
6–10	73	33.5
11–15	26	11.9
16–28	8	3.7
Education level		
Diploma	62	28.4
Bachelor	150	68.8
Master	5	2.3
Doctoral	1	0.5
Continuing education and training		
Yes	184	84.4
No	34	15.6

Table 1 *(Cont.)*

Demographic data	Frequency (*n*)	Percentage (%)
Work overload		
Yes	141	64.7
No	77	35.3
Working unit		
ICU	169	77.5
SICU	13	6.0
NICU	14	6.4
MICU	9	4.1
RICU	6	2.8
CCU	6	2.8
EICU	1	0.5

Note: ICU: general ICU; CCU: Cardiological Critical Unit; MICU: Medical ICU; NICU: Neurological ICU; EICU: Emergency ICU; RICU: Respiratory ICU; SICU: Surgical ICU

Level of Caring Practice for Critically Ill Patients

Table 2 displays the descriptive statistics for caring practice for critically ill patients. There was a high level of caring practice for critically ill patients among 76.6% of participants (*n* = 167), a moderate level among 21.6% of participants (*n* = 47), and a low level among only 1.8% of participants (*n* = 4). The overall mean score of P-TCCNI was 87.30 (SD = 13.73), which falls into the high level of caring practice for critically ill patients.

The mean score overall for each item and for subscales of P-TCCNI to reflect the caring practice for critically ill patients are presented in **Table 3**. The overall mean score of caring practice for critically ill patients was at a high level (M = 3.96, SD = 0.04). The subscale with the highest mean score was "Knowing persons is a multidimensional process" (M = 4.04, SD = 0.05). The subscale with the second highest mean score was "Technologies of health and nursing are elements for caring" (M = 4.01, SD = 0.05). The subscale with the second-lowest mean score was "Nursing as a discipline and professional practice" (M = 3.99, SD = 0.05). The subscale with the lowest score was "Persons are caring by virtue of their humanness" (M = 3.75, SD = 0.04).

Table 2 Descriptive statistics and the level of caring practice for critically ill patients (*N* = 218)

Level of Caring Practice	Frequency (*n*)	Percentage (%)
Min = 41, Max = 110, M = 87.30, SD = 13.73		
Low (22–51.33)	4	1.8
Moderate (51.34–80.66)	47	21.6
High (80.67–110)	167	76.6

*Min = Minimum, Max = Maximum, M = Mean, SD = Standard Deviation

Multivariate Analysis

Predictors of caring practice were analyzed by multiple linear regression using stepwise solution analysis, and professional value accounted for 17% variance of caring practice ($R^2 = 0.17$, $p < 0.001$) (**Table 4**). Professional value significantly predicted ICU nurses' caring practice for critically ill patients ($\beta = 0.41$, $p < 0.01$).

Table 3 Mean, standard deviation, score range, and level of caring practice categorized by overall, each item, and subscales (*N* = 218)

Caring Practice	M	SD	Score Range (Min–Max)	Level
Overall	3.96	0.04	1.86–5.00	High
Persons are caring by virtue of their humanness	3.75	0.04	1.75–5.0	High
1. I use special techniques which are appropriate for each patient to care for them.	3.79	0.88	1.00–5.00	
2. I know the patient's physical self and emotional conditions in a particular moment.	3.90	0.79	1.00–5.00	
3. I value patients that they know their own selves and their care routine well.	3.34	1.04	1.00–5.00	
4. I assist my patients in creating a shared sense of safety and security.	4.00	0.76	2.00–5.00	
The ideal of wholeness is a perspective of unity	4.00	0.05	2.00–5.00	High
5. I engage in compassion, physical presence, and comforting, and respect the whole person of my patients.	4.16	0.71	2.00–5.00	
6. I use technology and unbiased caring to build a patient's self-worth.	4.06	0.80	1.00–5.00	
7. I am more concerned about the patient's wholeness (e.g., background, belief, hope, and faith) than their physical parts.	4.00	0.86	1.00–5.00	
8. I concern about patients' personal hopes and dreams, which may change from one moment to the next.	3.81	0.87	1.00–5.00	

Table 3 *(Cont.)*

Caring Practice	M	SD	Score Range (Min–Max)	Level
Knowing persons is a multidimensional process	4.04	0.05	1.40–5.00	High
9. I use technology to know who and what the patient is, such as the patient's signs, symptoms, and needs.	4.10	0.75	2.00–5.00	
10. I provide caring for patients via listening to, doing things with, and being with the patient.	4.07	0.72	2.00–5.00	
11. I balance the demands of using machine technologies competently with caring in nursing.	4.14	0.76	2.00–5.00	
12. I pay attention to each patient's conditions and related data and include them in designing care plans to ensure the accuracy and completeness of my care.	4.00	0.83	1.00–5.00	
13. I use many ways of knowing to know the patient, such as communication, observation, reasoning, imagination, and sense-perception.	3.91	0.80	1.00–5.00	
Technologies of health and nursing are elements for caring	4.01	0.05	1.00–5.00	High
14. I use the machines/devices proficiently, aiming to provide the best care to my patients.	4.13	0.77	2.00–5.00	
15. I practice and follow up on tasks and emotions and use creativity in meeting/exceeding patient needs.	3.96	0.77	1.00–5.00	
16. I know the patient by involving and respecting the person as a whole person and complete in each moment.	3.98	0.77	1.00–5.00	
17. I use technology and human touch together in order to relate to patients with true presence and caring intentions.	3.97	0.79	2.00–5.00	
Nursing as a discipline and professional practice	3.99	0.05	1.20–5.00	High
18. I practice nursing within a caring perspective in the assessment and interpretation of healthcare data.	3.99	0.76	2.00–5.00	
19. I acknowledge patient needs while respecting all belief systems and focusing on patient healing.	4.06	0.77	1.00–5.00	
20. I, my patients, and their family members share knowledge and experience.	3.91	0.82	1.00–5.00	
21. I provide caring in nursing to reduce vulnerability and other stresses/anxiety inherent in nurse-patient relationships.	4.06	0.72	2.00–5.00	
22. I provide selfless commitment to patients' needs, hopes, and dreams.	3.97	0.79	1.00–5.00	

Table 4 The predictive factors of caring practice (N = 218)

Predictor variables [a]	Unstandardized coefficients		Standardized coefficients	t	p
	B	SE	β		
Age	−0.024	0.292	−0.008	−0.083	0.934
Work experience	0.212	0.340	0.058	0.625	0.533
Education level	−2.102	1.799	−0.079	−1.169	0.244
Influence of technology	−0.023	0.116	−0.013	−0.201	0.841
Professional value	0.527	0.082	0.412	6.388	0.000

Full model: R^2 = 0.17; p = 0.000

a: Dependent variable: caring practice

Discussion

The Level of Caring Practice

This study examined the level of nurses' caring practice for critically ill patients and its predictors. Little was known about the caring practice among ICU nurses in China. The results of this study showed that there was a high level of caring practice among ICU nurses (**Table 2**). The high level of caring practice was explored mainly because caring has been adopted as a core value in the nursing profession in China (Liu et al., 2019).

Since the High-Quality Care Demonstration Project (HQCDP) was conducted nationwide, both perception and knowledge of caring have been improving (Wang et al., 2014). The main point of this project is combining nursing and caring in daily care. When providing basic nursing services and professional technical services to patients, nurses should strengthen communication with patients and provide personalized care to patients (Wang et al., 2016). Patient-centered care has taken priority in nursing care, and it has increased nurses' awareness of the benefits of taking care of both the physical and mental health of patients. Thus, caring for patients has become a decisive element in nursing.

In the Chinese cultural context, caring is a complex concept including four categories: attitude, knowledge, ability, and perceptions of caring (Meng et al., 2011). Nurses should have the perception of respecting and loving patients. Nurses are responsible for patients' physiological and psychological health. Nurses conduct caring practice according to patients' needs. Therefore, nurses must always consider each patient's perspective and view each

patient as a participant (Meng et al., 2011). The concepts of caring and patients in the Chinese cultural context are similar to the concepts reflected in the theory of TCCN. In the theory of TCCN, patients are participants who are considered whole persons in each moment in technological environments (Locsin & Kongsuwan, 2018). Hence, it is unsurprising that this study indicated a high level of caring practice among Chinese ICU nurses.

Predictors of Caring Practice
Using regression analyses, the professional value was identified as a significant predictor of caring practice (β = 0.41, p = 0.00), which accounted for 17% variance in caring practice. This was the first study to use the NPVS to examine the relationship between professional values and ICU nurses' caring practice. Limited predictive studies were found in the literature review, but several correlational studies were identified. One correlational study conducted in a primary hospital indicated that professional value positively correlated with nurses' caring ability (r = 0.5, p < 0.01) (Hu, 2017). According to many participants' statements in the present study, it gives one a sense of achievement when patients are getting better, and this profoundly influences one's job satisfaction.

However, age, work experience (in ICU), education level, and influence of technology did not contribute to ICU nurses' caring practice. Similarly, in a prior study, a survey by Chen et al. (2016) showed that age was not associated with caring efficacy in a tertiary hospital. Conversely, Yau et al. (2019) indicated that there was a positive relationship between caring behaviors and age (r = 0.23, p < 0.01) in acute hospital settings. Moreover, Wu et al. (2019) reported that older ICU nurses had a higher level of caring ability (p < 0.05).

In this study, interestingly, work experience (in ICU) was not significantly associated with nurses' caring practice (p > 0.05). By comparison, Wu et al. (2019) revealed that work experience was correlated with the caring ability (p < 0.05). Similarly, findings from a study outside China showed nurses' caring capacity increased with work experience (Simmons & Cavanaugh, 2000). So, further study is needed to explain this phenomenon.

Education level also did not significantly contribute to ICU nurses' caring practice (p > 0.05). This finding contrasts with Su et al. (2014) finding that education level is positively related to caring capacity among ICU nurses (F = 8.29, p < 0.01). In the present study, education level was not significantly correlated with nurses' caring practice based on the theory of TCCN. As Chen et al. (2016) mentioned, many curricula at universities and colleges in China lack courses on caring. This is one possible reason for the opposing results.

Meanwhile, this study indicated that the influence of technology was not a predictor of caring practice for critically ill patients (p > 0.05). As ICU nurses mentioned, there were two opinions on the influence of technology on nurses' act of caring, similar to the opinions identified in some prior studies (Kongsuwan & Locsin, 2011; Petersen et al., 2019). Some nurses thought technology was a barrier to caring. They felt caring for patients was replaced by caring for technology in the ICU, especially for nurses unfamiliar with new and advanced technology. Other nurses thought that technology played the same important role as caring. They strongly believed that it was easier to get patients' physical data from machines and devices, which enabled them to provide adequate care.

Limitations
One limitation of this study was sampling bias. This study was conducted in tertiary hospitals in Guizhou province, where there were high numbers of technologies of health and nursing used in caring for critically ill patients. However, there are many kinds of technologies in secondary hospitals too. Another limitation was the low response rate (40.31%), likely caused by collecting data during the COVID-19 pandemic since nurses were extremely busy with overloaded work schedules.

Implications for Clinical Practice
There are several implications of this study: 1) It is essential for nursing administrators and policymakers to understand the current situation of caring practice in ICUs in China; 2) ICU nurses' professional value is a significant predictor of caring practice, which provides evidence for developing nursing programs for improving caring practice in ICUs; and 3) The P-TCCNI is a reliable and validated questionnaire to measure ICU nurses' caring practice.

Conclusion

This cross-sectional study showed that the level of ICU nurses' caring practice in tertiary hospitals in Guizhou province, China, was high. Professional value was found to be a predictor of caring practice, so it is recommended as a basic factor for improving the caring practice of ICU nurses. The P-TCCNI is recommended to be used as a tool to measure the ICU nurses' caring practice in further studies, such as in secondary hospitals in China or other countries.

Authors' Contributions
YL made significant contributions to the research proposal, the literature review, data collection, data analysis and interpretation,

and drafting of the article. WK made significant contributions to the research proposal, the literature review, study conception and design, data analysis and interpretation, drafted the article, and critical revision of the article.

Authors' Biographies

Yinglan Li is a Master of Nursing Science Student in Adult and Gerontological Nursing (International Program) at Prince of Songkla University in Southern Thailand.

Waraporn Kongsuwan, PhD, RN is an Associate Professor of Nursing, Faculty of Nursing, Prince of Songkla University, in Southern Thailand.

Data Availability Statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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