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Critical care nurses' knowledge, attitude, and practice regarding enteral nutrition interruption: a cross-sectional multicentre study

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Abstract

Background

Enteral nutrition interruption (ENI) in the intensive care unit frequently occurs and affects intake of feeding volume, ICU length of stay, and clinical outcomes. It is important for critical care nurses to understand ENI and implement interventions to prevent it.

Methods

A multicenter cross-sectional survey was conducted in 7 hospitals in Guangdong province, China, from January 2026 to February 2026. Descriptive statistics, Mann-Whitney U test, Kruskal-Wallis test, multiple linear regression, and spearman correlation coefficient tests were employed.

Results

A total of 454 eligible questionnaires were received for data analysis. The median scores of knowledge were 50.0 (IQR: 42.0–56.0), with mean scores of 49.7 and scoring rate of 71.0%; The median scores of attitude were 41.0 (IQR: 32.0–50.0), with mean scores of 41.3 and scoring rate of 82.7%; The median scores of practice were 68.0 (IQR: 60.0–79.0) with mean scores of 68.1 and scoring rate of 80.1%. There was a positive and significant relationship between knowledge, attitude and practice. Multiple linear regression analysis indicated that gender, head nurse and received training in ENI independently affected the knowledge; Head nurses and received training in ENI independently affected the attitude; Gender, ICU type, education level, and received training in ENI independently affected the practice.

Conclusions

Critical care nurses have inadequate knowledge, positive attitudes and good practices regarding ENI. There is room for improvement in knowledge and practice compared to attitude.

Clinical trial number: not applicable.

Background

A significant proportion of critically ill patients are at risk of malnutrition due to hypercatabolic state, systemic inflammatory responses, an increased energy requirement [1, 2]. Previous study indicated that the prevalence of malnutrition in the intensive care unit (ICU) ranged from 38% to 78% [3]. Malnutrition can lead to weight loss, infectious complications, prolonged stay in the ICU and days of mechanical ventilation, organ failure, and mortality [4–6]. Thus, the importance of nutrition therapy for critically ill patients is widely recognized by researchers and healthcare professionals [7].

Enteral nutrition (EN) has become the first line of medical nutrition therapy for critically ill patients [8, 9], as it is associated with gastrointestinal mucosa integrity and normal physiological metabolic processes [10, 11]. The guideline recommended that critically ill patients should meet 80–100% of target feeding volume after 3 days of initiating EN [9]. However, several observational studies have reported that 60–75% of patients do not reach target feeding volume in the ICU [12–14]. This is a matter of concern, because inadequacy of caloric and protein intake increases the risk of malnutrition and adverse outcomes [15].

A common reason for inadequate intake of feeding volume in critically ill patients is an enteral nutrition interruption (ENI) [16]. ENI in the ICU frequently occurred, with its prevalence ranging from 54% to 84% in some published literature [17–19]. Study has indicated that patients with ENI had higher rate of underfeeding (54.0% vs. 15.0%) and an increased mortality rate (46.0% vs. 21.7%) than without ENI [20]. Therefore, recognizing the reasons for underfeeding is vital for the prevention of ENI. The causes of ENI include a variety of patient-related and diagnostic or therapeutic interventions factors in the ICU [21].

Moreover, hemodynamic instability, gastrointestinal bleeding, difficulties in nasogastric tube placement, and other unknown causes further contribute to ENI [22].

Study has shown that approximately 72% of the total time of ENI is associated with human factors and can be considered avoidable [23]. For example, inadequate practices by professionals including incorrect prescription, late start of EN, and unnecessary pauses can lead to the occurrence and duration of ENI [16, 24]. Critical care nurses, as the primary role in assessment nutritional needs, implementation EN plans, monitoring complication, are closely related to the occurrence of ENI in critical ill patients [25, 26]. However, there is currently no universal consensus on the definition of ENI across various studies [20]. Besides, guideline for EN administration to critically ill patients only indicated that “continuous EN to avoid interruptions”, without offering specific protocols for minimizing ENI [9]. This makes it difficult for critical care nurses to implement standardization management to prevent the occurrence of ENI.

The knowledge-attitude-practice (KAP) theory proposes that adequate knowledge and positive attitude can facilitate behavioural changes, and deliver better patient outcomes [27]. Consequently, critical care nurses’ level of knowledge, attitude and consequent practice might influence the occurrence of ENI. However, there is a scarcity of published studies examining the critical care nurses’ KAP regarding ENI. When available, they often focused on the awareness or knowledge of critical care nurses within one geographical area regarding ENI [28, 29]. Nurses from diverse regions are certain to face different clinical problems and medical environment [30]. Therefore, the aims of the study are to evaluate the knowledge, attitude and practice (KAP) regarding ENI among critical care nurses in Guangdong province, China, and analyze the factors influencing the KAP regarding ENI.

Methods

Study aim

This study was designed with two primary objectives: firstly, to investigate the KAP regarding ENI among critical care nurses in Guangdong Province, China; secondly, to analyze the influencing factors associated with nurses’ KAP regarding ENI.

Study design

A multicenter cross-sectional study based on online self-administered questionnaires was conducted in this research. The entire process of data collection, statistical analysis, and manuscript reporting strictly followed the reporting guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

Study setting and Sampling

Participants were recruited from seven tertiary hospitals in Guangdong Province of China from January to February 2026. A convenience sampling strategy was adopted to enroll eligible critical care nurses.

Study participants

All participants met the following inclusion criteria: obtaining a Nursing Practice Certificate issued by the Ministry of Health of China, being engaged in clinical nursing work for patients receiving enteral nutrition therapy, and voluntarily participating in this survey. In contrast, nurses with clinical working experience of less than 12 months were excluded from the present study.

Study instrument

The survey questionnaire used in the study was developed on the basis of systematic literature review and relevant evidence summary. The final version of the questionnaire consisted of two parts after two rounds of group discussion and content revision.

The first part included participants' basic demographic and occupational characteristics, including age, gender, ICU working years, education level, ICU type, technical title and position. There were also two ancillary questions including whether they were a member of the nutrition support group and whether they received training in ENI.

The second part consists of the "ICU Enteral Nutrition Interruption Knowledge, Attitude, and Practice Scale" developed by Mi [29]. This scale has been verified to be suitable for Chinese critical care nursing populations. The scale comprises three dimensions: knowledge, attitude, and practice. The knowledge dimension included 14 items and was evaluated using a 5-level Likert scale from "completely unaware" to "completely aware" with total scores ranging from 14 to 70. The attitude dimension consisted of 10 items and was evaluated using a 5-level Likert scale (1= "completely disagree" to 5= "completely agree"), allowing a score range of 5–50 points. Similarly, the practice dimension was evaluated using a 5-level Likert scale from (from 1= "never" to 5= "always"). With a total of 17 items, the score range was 17–75 points. Higher scores for each dimension would indicate higher level of KAP regarding ENI among ICU nurses. The Cronbach' s alpha of the scale was 0.953, the test-retest reliability was 0.795, and the total content validity coefficient was 0.975. In the study, the scoring rate of each dimension = mean scores/theoretical maximum × 100%. A dimension scoring rate of 80% or above is regarded as possessing adequate knowledge, attitude and practice for delivering safe and effective nursing care.

Ethical Approval

The research protocol was reviewed and formally approved by the ethics committee of the affiliated research institution (Ethical Approval Number: ES-2025-K055-01). Prior to questionnaire filling, all participants were informed of the research background, study purposes, survey procedures, and personal rights during the investigation. The completion and submission of the electronic questionnaire was regarded as effective informed consent for study participation.

Data collection

In the study, All research data were collected through the Wenjuanxing online questionnaire platform. Before formal data collection, consent and cooperation were obtained from ICU nursing department leaders of all participating hospitals, and professional hyperlinks and QR codes were sent through WeChat. Then, each nursing department leader sent an electronic questionnaire to all eligible nurses in their department.

A standardized filling guideline was placed on the first page of the electronic questionnaire to explain how to answer the questionnaire in detail. To avoid missing data and repeated submission, the questionnaire system was set with mandatory response for all items and single IP address submission restriction. Participants had the right to terminate the survey at any time during filling. Unfinished and unsubmitted questionnaires would not be retained, and no modification was available after successful submission.

Data analysis

All statistical analyses in this study were performed using SPSS 25.0. The Kolmogorov-Smirnov test and Shapiro-Wilk test were used to test the normality of KAP scores, revealing the scores of KAP were not a normal distribution ($p < 0.05$). As a result, nonparametric statistical methods were adopted for subsequent data analysis.

Descriptive statistics were presented as frequencies, percentages, and medians with interquartile ranges (IQR). Spearman correlation analysis was used to analyze the correlation among KAP. The Mann-Whitney U test and Kruskal-Wallis test were used to examine the variations in KAP scores based on critical care nurses' characteristics. The characteristics of P-values less than 0.1 were included in the multiple linear regression model to further explore the independent factors affecting the KAP scores. A two-tailed P-values less than 0.05 were considered statistically significant.

Results

Participants' characteristics

A total of 454 questionnaires were received, of which 15 were excluded because of obvious filling errors, leaving 439 eligible questionnaires for data analysis. 77.4% participants were female, and 85.7% were aged 20 to 40 years old. In terms of ICU working years, 37.4% participants were 1-5 years. The detailed demographic characteristics were presented in Table 1.

Table 1. Demographic characteristics associated with KAP regarding ENI among critical care nurses (n=439)

Demographics	Number (%)	Median knowledge[Q1-Q3]	*P* value	Median Attitude[Q1-Q3]	*P* value	Median Practice[Q1-Q3]	*P* value
Gender							
Male	99(22.6%)	48[42,55]	0.019[a]	40[33,50]	0.958[a]	67[54,76]	0.021[a]
Female	340(77.4%)	50[42,57]		41.5[31,50]		69[62,79]	
Age (year)							
20-30 years	186(42.4%)	47.5[42,56]	0.379[b]	40[30,50]	0.418[b]	68[60,79]	0.806[b]
31-40 years	190(43.3%)	50.5[42,58]		42[33.75,50]		68[61,77.5]	
>41 years	63(14.4%)	51[44,56]		46[30,50]		70[58,79]	
ICU working years							
1-5 years	164(37.4%)	47[42,56]	0.073[b]	40[32,50]	0.741[b]	68[60,80]	0.658[b]
6-10 years	121(27.6%)	51[42,57]		45[30.5,50]		68[60,77.5]	
11-15 years	89(20.3%)	49[40,56]		40[32.5,50]		68[62,76]	
≥16 years	65(14.8%)	52[44.5,58]		43[30,50]		71[61,79.5]	
Education level							
College or below	34(7.7%)	49[42,55.25]	0.322[b]	49[32,50]	0.363[b]	71.5[62,79.5]	0.482[b]
Bachelor	395(90.0%)	50[42,56]		40[31,50]		68[60,78]	
Master or above	10(2.3%)	56.5[44.25,63]		47.5[34.5,50]		674[55,80.75]	
ICU type							
General ICU	293(66.7%)	49[42,57]	0.682[a]	40[30,50]	0.204[a]	68[58,78]	0.039[a]
Speciality ICU	146(33.3%)	50[42,56]		44[38,50]		70[63.75,79]	
Technical title							
Primary	240(54.7%)	48[42,56]	0.036[b]	40[31.25,50]	0.276[b]	68[60,79]	0.925[b]
Moderate	163(37.1%)	51[42,58]		42[32,50]		68[61,79]	
Senior	36(8.2%)	52[47,59.5]		47[32.25,50]		68.5[60.25,77.75]	
Contract type							
Permanent	113(25.7%)	52[43.5,58]	0.092[a]	43[32,50]	0.549[a]	69[61,80]	0.370[a]
Casual/Contracted	326(74.3%)	49[42,56]		40.5[32,50]		68[60,78]	
Teacher nurse							
No	344(87.6%)	48[42,56]	0.036[a]	40[30,50]	0.240[a]	68[60,79]	0.885[a]
Yes	95(12.4%)	52[45,57]		43[38,50]		69[62,78]	
Head nurse							
No	423(96.4%)	49[42,56]	0.021[a]	40[31,50]	0.001[a]	68[60,78]	0.176[a]

Yes	16(3.6%)	57[48.25,63]		50[48,50]		74.5[64,81.5]	
A member of the nutrition support group							
No	65(14.8%)	49[42,60]	0.433[a]	44[30,50]	0.693[a]	74[64.5,80]	0.037[a]
Yes	374(85.2%)	50[42,56]		40.5[32,50]		68[60,78]	
Received training in enteral nutrition interruption							
No	79(18.0%)	44[40,50]	0.001[a]	40[30,47]	0.001[a]	64[54,75]	0.001[a]
Yes	360(82.0%)	51[42,57]		45[32.25,50]		69[62,80]	

Abbreviations: ICU, intensive care unit

[a] *p*-value is calculated using the Mann-Whitney U test

[b] *p*-value is calculated using the Kruskal-Wallis test

Critical care nurses' knowledge regarding ENI among critical care nurses

The median scores were 50.0 (IQR: 42.0-56.0), with average score of 49.7 and scoring rate of 71.0%. Only 142 (32.3%) critical care nurses who had scoring rate of 80% or above were considered to have good knowledge, showing inadequate knowledge regarding ENI. The items with lowest scoring rate were the question including the definition of ENI and adverse consequences for patients after ENI. The detailed scoring rate of each item of knowledge dimension were shown in Supplementary file 1.

Critical care nurses' attitude regarding ENI among critical care nurses

The median scores were 41.0 (IQR: 32.0-50.0), with average score of 41.3 and scoring rate of 82.7%. In general, 288 (65.6%) critical care nurses had scoring rate of 80% or above, showing a overall positive attitude regarding ENI. The detailed scoring rate of each item of attitude dimension were shown in Supplementary file 1.

Critical care nurses' practice regarding ENI among critical care nurses

The median scores were 68.0 (IQR: 60.0-79.0), with average score of 68.1 and scoring rate of 80.1%. Overall, critical care nurses' practice regarding ENI is good, and 247 (56.3%) critical care nurses had scoring rate of 80% or above. The items with lowest scoring rate were the questions including initiative learning relevant information regarding ENI, communication with patients or their families, evaluation patients' nutritional status and establish the appropriate feeding route. The detailed scoring rate of each item of practice dimension were shown in Supplementary file 1.

Correlation analysis of critical care nurses' KAP regarding ENI

Spearman coefficient tests showed a significantly positive correlations between knowledge and attitude (r=0.551, p=0.001), knowledge and practice (r=0.607, p=0.001), and attitude and practice (r=0.528, p=0.001). Detailed data were presented in Table 2.

Table 2. Correlations of KAP regarding ENI among critical care nurses (n=439)

	r-value	*p*-value
The knowledge and attitude	0.551	0.001
The knowledge and practice	0.607	0.001
The attitude and practice	0.528	0.001

Factors affecting the critical care nurses' KAP regarding ENI

After multiple linear regression analysis, we found that gender, head nurse and received training in ENI independently affected critical care nurses' knowledge regarding ENI. Head nurses and received training in ENI independently affected critical care nurses' attitude regarding ENI. Gender, ICU type, education level, and received training in ENI independently affected critical care nurses' practice regarding ENI. Detailed data were presented in Table 3.

Table 3. Multiple linear regression analysis of KAP regarding ENI among critical care nurses (n=439)

Dependent variables	Independent variables	*B*	Std. error	*β*	*t* value	*95CI*	*P*-value
Knowledge score[a]	Constant	25.944	4.142		6.263	17.803-34.085	0.001
	Gender	2.784	1.167	0.110	2.386	0.491-5.078	0.017
	Head nurse	6.504	2.600	0.115	2.502	1.395-11.613	0.013
	Received training in ENI	6.641	1.268	0.240	5.236	4.148-9.134	0.001
Attitude score[b]	Constant	28.077	2.939		9.553	22.301-33.853	0.001
	Head nurse	6.680	2.130	0.147	3.137	2.495-10.866	0.002
	Received training in ENI	3.483	1.039	0.157	3.352	1.441-5.524	0.001
Practice score[c]	Constant	55.128	4.997		11.031	45.305-64.950	0.001
	Gender	3.309	1.377	0.104	2.208	0.333-5.745	0.028
	ICU type	2.427	1.218	0.093	1.992	0.032-4.822	0.047
	Received training in ENI	5.313	1.488	0.166	3.569	2.387-8.238	0.001

Abbreviations: ICU, intensive care unit

Knowledge score[a]: R=0.290; R^2=0.084; adjusted R^2=0.078; F=13.335; P=0.001

Attitude score[b]: R=0.214; R^2=0.046; adjusted R^2=0.042; F=10.500; P=0.001

Practice score[c]: R=0.247; R^2=0.061; adjusted R^2=0.052; F=7.047; P=0.001

Discussion

ENI has attracted considerable attention in critical care research as a major contributor to inadequate nutritional delivery in critically ill patients [31]. Nurses are essential in providing and managing optimal feeding care in the ICU as they are at the forefront of EN administration [26]. This study reports the findings of a regional survey aimed at exploring the knowledge attitude, and practice of ENI among intensive care nurses. Overall, the study found that scoring rate of knowledge and practice was the lower compared to the scoring rate of attitude, suggesting that there was room for further improvement in critical care nurses' knowledge and practice. Similarly, a recent systematic review found that critical care nurses had positive attitudes towards enteral feeding, though gaps persist in their knowledge and clinical practice [32]. It should be

given priority for critical care nurses to develop educational measurements to enhance the knowledge and practice regarding ENI in nurses caring for patients.

In the knowledge dimension, critical care nurses showed a low level of knowledge towards ENI, with particularly obvious deficiency in the definition and consequences of ENI. This is consistent with previous findings that critical care nurses had poor knowledge about the definition, causes, and consequences of ENI [28]. This may be attributed to the fact that there is currently no universal consensus on the definition of ENI, particularly regarding interruption duration [20]. For instance, O'leary-Kelley, et al [33] defined ENI as interruptions lasting over 15 min, while Salciute-Simene, et al [34] set the threshold at 1 h. This variability in definitions can lead to confusion among critical care nurses when pausing and resuming the administration of enteral nutrition [28]. The study has indicated that the occurrence of ENI in the ICU is mainly due to human factors, either medical procedure-related or avoidable reasons. Therefore, future studies should standardize the definition of ENI and establish a consistent threshold for ENI duration and frequency to guide critical care nurses in improving patient care.

Overall, critical care nurses' practice regarding ENI is good, except for the low initiative in learning about ENI, conducting nutritional assessment, and communicating patients or their families. Notably, the results showed that most critical care nurses had positive attitude regarding ENI. This above discrepancy indicates that although critical care nurses are aware of the importance regarding ENI, their actions of active learning and thinking are inadequate. Nurses from tertiary hospitals were included in the study. Medical staff at tertiary hospitals had more rigorous assessment systems in the clinical treatment, scientific research, and teaching responsibilities, which may lead to lower learning enthusiasm because of heavier workload [28, 35]. Moreover, a national survey has found that enteral nutrition is usually given lower priority than other urgent and vital care needs for critical ill patients [36]. Nursing managers should reasonably allocate human resources, incorporate ENI priority in care routines and develop clearly concise education lectures to promote nurses' proactive actions.

Consistent with the theory of planned behaviour [37], there was a statistically significant positive correlation between the critical care nurses' KAP scores regarding ENI in the present study. This result can be also supported by the viewpoint that integrating intrinsic knowledge and positive attitude can be converted into extrinsic behaviors [38]. Nurses play a central role in the monitoring of nutritional status and management of ENI in ICU patients [39]. Critical care nurses who possess adequate understandings of ENI are more likely to realize the importance of administration and apply appropriate practices confidently. Therefore, it is suggested to develop various continuing education platforms such as theoretical training, lectures, and workshops to enhance critical care nurses' comprehensive knowledge regarding ENI.

The present study showed that female nurses had significantly higher knowledge and practice scores towards ENI than male nurses. On the one hand, female nurses are generally higher patient, initiative and compliance with standardized feeding procedures. On the other hand, it might also be attributed to the fact that nutrition management is usually female-dominant and therefore female nurses might have more nutrition-related knowledge and practice [13]. Targeted professional training should be strengthened for male nurses to reduce gender differences in knowledge and clinical practice of ENI. Furthermore, our findings showed that there were significantly higher knowledge and attitude scores towards ENI among head nurses. This may be because head nurses have richer working experience, stronger learning enthusiasm, greater access to the latest practice standardization, thereby fostering a more higher knowledge and positive attitude [39]. Therefore, nursing managers are responsible for improving leadership ability to motivate nurses to pursue continuous learning and professional competence.

The present study showed that critical care nurses who received training in ENI had higher knowledge, attitude and practice scores. The finding is not a surprise, and supports the evidence that training or education can reduce nurses' confusion about nutrition support protocols and thus improve their abilities to manage ENI [24, 32, 40]. The study has showed that regular training sessions can improve nurses' knowledge [39]. It is suggested that continuous training based on the updated guideline or consensus is necessary to maximise ability of ENI among critical care nurses. The present study demonstrated

the statistical differences in ICU type, and ICU nurses from speciality ICU reported higher knowledge scores. This may be because nurses in speciality ICUs focus on long-term nutritional support and provide more opportunities to deepen their practice. By contrast, general ICUs cover a broader range of diseases, limiting nurses' proficiency in standardized enteral feeding management.

Limitations

The present study has several limitations. The data were collected by convenience sampling with self-report methods, which might lead to information bias owing to concealment or potential social desirability preference. In addition, participants were sampled from Guangdong province by using convenient sampling, which reduced the generalizability. Wilcoxon rank sum test (Mann-Whitney U test and Kruskal-Wallis test) was the main statistical methods in the study because of non-normally distributed data. This approach did not fully utilize the information contained in the data, leading to relatively lower test efficiency than parametric tests. Given the large sample size in this study, the test efficiency of Wilcoxon rank sum test results was ensured to some extent in the study.

Implications for practice

There was room for further improvement in critical care nurses' knowledge and practice regarding vasoactive agents infusions in this study. Therefore, there is an urgent need for to develop educational measurements to enhance the knowledge and practice regarding ENI in nurses caring for patients. Besides, it is vital to standardize the definition of ENI and establish a consistent threshold for ENI duration and frequency to guide critical care nurses in improving patient care. Moreover, nursing managers should reasonably allocate human resources and develop clearly concise education lectures to promote nurses' proactive actions.

Conclusions

In the study, critical care nurses have inadequate knowledge, positive attitudes and good practices regarding ENI in Guangdong province, China. In addition, there is room for improvement in knowledge and practice compared to attitude. It should be given priority for critical care nurses to educational inventions such as theoretical training, lectures, and workshops to enhance the knowledge and practice regarding ENI in nurses caring for patients. Moreover, standardizing the definition of ENI and establishing a consistent threshold for ENI duration and frequency are necessary to better guide nurses in improving patient care.

Abbreviations

ICU
Intensive Care Unit
EN
Enteral Nutrition
ENI
Enteral Nutrition Interruption
IQR
Interquartile Range
KAP
Knowledge, Attitude and Practice

Declarations

Ethics approval and consent to participate

This study was approved by the ethics committee of the First Affiliated Hospital of Guangzhou Medical University (ES-2025-K055-01) and adhered to the Declaration of Helsinki. All participants provided informed consent after they were informed about the study.

Consent for publication

Not applicable.

Availability of data and materials

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

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

LC, QS, YD and ZL designed the study and write the research protocol; LC, XL, CL, LZ, HC, LC and LC did the literature, quality control, collected and checked the data; LC, YT, SZ, LZ and TH analyzed the data, interpretation of data; LC and QS prepared the manuscript. All authors provided critical review of the manuscript and approved the final manuscript.

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