

Original Article

Intensivists' cognizance of nutrition management and its determinants in ICUs in Guizhou province, China

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Background and Objectives: To investigate the Intensivists' cognizance of nutritional management and its determinants, and to provide evidence for standardizing nutritional therapy with protocols. **Methods and Study Design:** From April to July 2021, a multi-stage sampling method was used to investigate the nutritional cognizance of critical care physicians in secondary and tertiary hospitals in Guizhou Province, China; Questionnaires and scales were used as survey tools. The questionnaires sought general information about the respondents and documented their nutrition cognizance and practice. Five scalar dimensions explored nutritional management, with answers scored for 1-5 points, 3 points being the pass score. **Results:** 322 respondents from 147 hospitals were surveyed. The average score was passable, but not good at 3.37 ± 0.71 ($p < 0.01$ with 3.0 as reference). Among the five dimensions, evaluation and monitoring of nutritional status had the highest score (3.79 ± 0.67 , $p < 0.01$), the understanding of nutritional preparations had the lowest (3.09 ± 0.86 , $p > 0.05$), and the scores of other dimensions ranged from 3.21 to 3.49. Almost 70% of intensivists said that they would give priority to other than nutritional therapeutic measures in actual clinical practice. But 96% thought it necessary to strengthen and emphasise nutritional management. **Conclusions:** Critical care physicians' knowledge and understanding of nutritional therapy are limited, especially in the use of supportive preparations; Recourse to protocols and standardized nutritional management of assistance may depend on training, assigned role, peer expectations and health system policy, each of which has the potential for advancement in the interest of better nutritional care in provincial Guizhou.

Key Words: critical care medicine, intensivist, nutritional therapy, nutritional support, Continuing Nutrition Education (CNE)

INTRODUCTION

With the rapid development of Critical Care Medicine (CCM), the research on critical care nutritional therapy has intensified and the concept transformed from "nutritional support" to "nutritional therapy",¹ important for the comprehensive management of patients in Intensive Care Units (ICU). However, nutritional therapy still suffers from deficiencies and misunderstandings in its implementation, which may reflect in medical staff awareness and application of guidelines for nutritional indications.²⁻⁶ Formative and continuing nutritional education (CNE) of medical practitioners involved in critical care would provide a vehicle to address these concerns,⁶⁻⁸ to which evidence-based nutritional (EBN) therapy protocols could contribute. Knowledge and understanding (cognizance) develop and reinforce more optimal attitudes and practice. The prospects are likely to be more favourable if generated and supported by the relevant practitioners, in this case those in critical care medicine physician. The present study explores intensivists' perceptions of nutrition management and how standardised protocols might affect practice.

METHODS

Intensivists

Intensivists included had appointments at Guizhou prefecture-level or county-level public hospitals with comprehensive ICU. Those excluded were medical staff in specialized and private hospitals, specialized ICU, student and advanced trainees, and interns.

Sample size calculation

The Guizhou Quality Control Center of Critical Care Medicine used the formula $N_1 = u_{\alpha/2}^2 \pi(1-\pi) / \delta^2$ ($\pi = 0.5$, a two-sided $\alpha = 0.05$, $\delta = 0.05$) to calculate sample size. To allow for the total number of physicians and invalid questionnaires, the sample size was corrected and expanded

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by 5%. Thus, the final respondent sample size required was 320.

Survey methodology

A multi-stage sampling method was used in 5 on-site investigations of all prefecture-level and county-level hospitals in Guizhou province from April to July 2021, based on the “2021 Quality Control Action for Critical Care Medicine”. Duty physicians were asked to complete the questionnaire anonymously at the time. Answers were scaled in the survey tools, and item design was made by reference to nutrition guidelines^{1,9} and critical care medicine textbooks,^{10,11} and was reviewed and revised by several senior practitioners with relevant academic backgrounds. The questionnaire is divided into two parts. The first part seeks general sociodemographic and occupational information from the respondents including, such as gender, age, educational background, professional title, hospital grade, and working time (8 questions). The second part is the multiple choice and about nutritional management considerations (3 questions). The scale was 5-level Likert scale (31 questions), and a pre-survey and reliability and validity test were conducted in November 2020. After revision, it was finally divided into 5 sections: (i) cognizing and learning of nutrition (ii) timing and principles of nutritional support (iii) evaluation and monitoring of nutritional status (iv) energy and protein requirements and (v) knowledge of nutritional preparations. The options for each topic were divided into 5 levels, corresponding to points: 3 points were a pass, and 4 points or above were considered excellent. For missing questionnaire, responses, on-site contact was made for completion. Data were recorded by two people independently. Invalid data were processed in accordance with a predetermined protocol, alert to possible tampering and fabrication. The study was approved by the Ethics Committee of Guizhou Medical University. It was registered with the Chinese Clinical Trial Registry, ChiCTR2100050265.

Statistical analysis

SPSS 25.0 software was used for statistical analysis. Count data were expressed by rate and ratio. Measurements derived were mean \pm standard deviation, t test, F test, and Pearson correlation analysis method. Multiple linear regression was used to estimate relative correlations between variables. $p < 0.05$ was statistically significant.

RESULTS

Intensivist characteristics

The enquiry was divided into five sections. Some 330 questionnaires were distributed to 147 prefecture-level public general hospitals in Guizhou Province, and 322 questionnaires were recovered with a rate of 97.6%, reaching the effective sample size.

Cronbach's Alpha was used to test scale reliability; KMO and Bartlett Sphericity to test scale validity. Cronbach's Alpha > 0.9 means the internal consistency of the scale was very high; KMO > 0.6 , and Bartlett Sphericity test $p < 0.05$, indicating that the scale has good structural validity. The Cronbach's Alpha and KMO of the

questionnaire were 0.97 and 0.96 respectively, and the Bartlett spherical test $p < 0.01$, indicated that the scale has good reliability and validity.

A total of 322 intensivists were enrolled, including 259 from 112 hospitals for Western medicine and 63 from 35 hospitals for Traditional Chinese medicine. There were 108 respondents from 43 tertiary hospitals and 215 from 104 secondary hospitals; 214 men (66.5%) and 108 women (33.5%); 77 (23.9%) under 30 years old, 205 (63.5%) between 30 and 39 years old, 36 (11.2%) between 40 and 49 years old, and 4 (1.24%) over 50 years old. (Table 1).

Nutrition cognition

The average score of the intensivists was 3.37 ± 0.71 ($p < 0.01$ with 3.0 as reference), 96 (29.8%) failed, 226 (70.2%) passed, and 68 (21.1%) were excellent. Among all dimensions, the highest score was 3.79 ± 0.67 ($p < 0.01$) in the evaluation and monitoring of nutritional status, and the lowest score was 3.09 ± 0.86 ($p > 0.05$) in the understanding of nutritional preparations. The average score of other dimensions was 3.21-3.49. The scores of the subjects in each dimension are shown in Table 2.

All respondents strongly agreed on the role of nutritional support (4.73 ± 0.65), but different educational backgrounds, professional titles, ICU working time, ICU construction time and hospital grade had significant statistical significance on the understanding of nutritional preparations (see Table 1 for details). LDS-t (Least Significant Difference-test) was used for multiple comparison. Combined with Table 1 and the actual work situation, clinicians' understanding of nutritional preparations increased with increased working hours, professional titles and hospital grades. Pearson correlation analysis method was used to analyze the correlations among the five dimensions of nutritional support scale. The correlations between the five dimensions were significant and positive ($p < 0.01$). Further multiple linear regression analysis was used, with knowledge of nutritional preparations as the dependent variable and the other four dimensions as the independent variables, the regression equation was obtained: Knowledge of nutritional preparations = $0.46 \times$ Energy and protein requirements + $0.27 \times$ Cognizing and learning of nutrition + $0.19 \times$ Evaluation and monitoring of nutritional status + $0.17 \times$ Timing and principles of use of nutritional support - 0.45 ($R^2 = 0.78 > 0.6$, $F = 286.4$, $p < 0.01$, all VIF < 5). The goodness of fit of regression model is good, the regression equation is significant and there is no collinearity between independent variables.

ICU nutrition implementation and its determinants

For the survey instrument (Supplementary table 1) *item 9*, “reasons hindering the popularization of nutritional therapy”, 68.6% of physicians considered priority was given educationally (“learning”), and implicitly in practice assigned to other non-nutritional therapeutic measures; in *item 10*, the “measures to enhance the awareness and initiative of nutritional therapy in ICU care”, 95.7% physicians believed that the importance of nutritional therapy should be strengthened. In *item 11*, the “Use enteral nutrition preparations”, 88.8% of physicians recommended that diet be made by the patients' family members, as shown in Table 3.

Table 1. Intensivist characteristics & nutritional management knowledge scores (n=322)

Variable	Total	%	Knowledge of nutritional preparation (mean±SD)	Timing and principles of nutritional support (mean±SD)	Evaluation and monitoring of nutritional status (mean±SD)	Total score of scale (mean±SD)
Education background						
Junior college	10	3.10	2.48±0.80	2.88±0.70	3.77±0.47	2.97±0.53
Undergraduate	298	92.6	3.10±0.84	3.47±0.79	3.78±0.67	3.41±0.68
Master	13	4.04	3.19±0.99	3.77±0.85	4.06±0.66	3.65±0.71
PhD	1	0.31	5	5	5	5
<i>p</i> value			<0.05 [†]	<0.05 [‡]	>0.05 [§]	<0.05 [¶]
Professional title						
Indefinite	19	5.90	2.87±0.98	3.09±0.87	3.76±0.60	3.17±0.78
Resident physician	142	44.1	2.96±0.80	3.37±0.79	3.76±0.66	3.32±0.65
Attending physician	116	36.0	3.13±0.88	3.52±0.8	3.76±0.73	3.44±0.71
Associate chief physician	43	13.4	3.50±0.81	3.79±0.66	3.99±0.53	3.74±0.59
Chief physician	2	0.62	3.00±1.13	3.67±1.18	3.83±0.71	3.34±1.02
<i>p</i> value			<0.05 [†]	<0.05 [‡]	>0.05 [§]	<0.05 [¶]
Time spent in ICU [†]						
~1year	47	14.6	2.71±0.71	3.03±0.75	3.57±0.60	3.08±0.57
~3yaers	74	23.0	2.82±0.78	3.24±0.8	3.65±0.69	3.19±0.66
~5yaers	72	22.4	3.11±0.90	3.50±0.75	3.78±0.68	3.43±0.70
~10yaers	104	32.3	3.30±0.82	3.69±0.74	3.94±0.64	3.61±0.63
>10yaers	25	7.76	3.59±0.87	3.94±0.74	4.05±0.67	3.84±0.70
<i>p</i> value			<0.05 [†]	<0.05 [‡]	<0.05 [§]	<0.05 [¶]
ICU establishment time						
~5years	100	31.1	2.88±0.84	3.21±0.81	3.64±0.68	3.21±0.70
~10yaers	157	48.8	3.11±0.85	3.51±0.78	3.79±0.67	3.43±0.67
>10yaers	65	20.2	3.36±0.82	3.77±0.71	4.04±0.59	3.68±0.62
<i>p</i> value			<0.05 [†]	<0.05 [‡]	<0.05 [§]	<0.05 [¶]
Hospital grade						
Second-class hospital	214	66.5	2.97±0.83	3.36±0.80	3.70±0.67	3.31±0.66
Qualified tertiary hospital	27	8.39	3.36±0.96	3.65±0.85	4.02±0.76	3.63±0.80
Class B tertiary hospital	24	7.45	3.16±0.89	3.49±0.84	3.87±0.58	3.43±0.72
Class A tertiary hospital	57	17.7	3.36±0.84	3.78±0.68	4.01±0.59	3.70±0.61
<i>p</i> value			<0.05 [†]	<0.05 [‡]	<0.05 [§]	<0.05 [¶]

ICU: intensive care unit.

[†]Comparison of scores about different research objects in the knowledge of nutritional preparations.[‡]Comparison of scores about different research objects in the timing and principles of nutritional support.[§]Comparison of scores of different research objects in the evaluation and monitoring of nutritional status.[¶]Comparison of scores of different research objects in the total score of scale.

Table 2. Score and pass rate of subjects in all dimensions (n=322 persons)

Dimensions (question number)	Full marks	Lowest score	Highest score	Score (mean±SD)	Pass rate (%)	<i>p</i> value [†]
Cognizance and learning about nutrition (5)	5	1.60	5	3.21±0.71	63.4	<0.01
Timing and principles of nutritional support (6)	5	1.33	5	3.47±0.80	76.1	<0.01
Evaluation and monitoring of nutritional status (6)	5	1.83	5	3.79±0.67	88.5	<0.01
Energy and protein requirements (4)	5	1.25	5	3.49±0.88	73.4	<0.01
Knowledge about nutritional preparations (10)	5	1.20	5	3.09±0.86	50.0	0.71
Total scalar score (31)	5	1.81	5	3.37±0.71	70.2	<0.01

[†]The statistical value of the score vs pass score (3 points).

Table 3. ICU nutrition implementation: intensivist alleged determinative of preferred options (n=322)

Title (number of options) and top 3 choices	Percentage (%)
9. Reasons for hindering the popularization of nutritional therapy (6)	
Doctors focus on or learn about other treatments as the priority	68.6
Local health insurance policies restrict access to nutritional treatment	67.3
Doctors are not clear about the importance of nutritional treatment	57.2
10. Measures to enhance ICU [†] physicians' awareness and initiative in nutritional therapy are recommended (6)	
Strengthen the evidence-based knowledge of nutrition support in the training of medical staff	98.1
Emphasize nutritional support as important as any other treatment modality	95.7
Include nutritional treatment in health insurance policies	87.0
11. The use structure of enteral nutritional therapeutic agents (8)	
"Diet" made by family members of patients	88.8
Medical enteral nutrition preparations	71.1
Ordinary milk powder purchased in the market	58.4

ICU: intensive care unit.

DISCUSSION

Nutritional management rationale in critical care

The seriously ill are highly catabolic at an early stage.¹² If nutritional management is not timely, it will accentuate dysnutrition, so delaying recovery, compromising rehabilitation and limiting ultimate prognosis. The prevalence of malnutrition in ICU wards is as high as 38-78%,¹³ and closely related to clinical outcome, immunodeficiency, organ dysfunction and increased mortality.¹⁴⁻¹⁶ Nutritional therapy can mitigate these consequences with, inter alia, less sepsis related to intestinal dysfunction, especially by early enteral nutrition.¹⁷ Standardized nutritional management protocols offer a more likely and reliable framework to favour better nutritionally-dependent outcomes in critical care.¹²

Standardised nutritional care protocols have systemic merit

The present study provides some insight into factors that do or do not motivate critical care physician leaders and decision-makers to implement EBN therapy. They are health system related, sociocultural, attitudinal, informational, skill-related, and cognizant. The Guizhou ICU survey points in some measure to each of these, and purports that standardised nutritional management protocols would be an intervention with systemic benefits for the critically ill.

Intensivist cognizance for nutrition management

The average cognizant score for intensivists was 3.37±0.71 (*p*<0.01 with 3.0 as reference), 52.8% of the potential total score. Only 21.1% of respondents had a good grasp of nutritional therapy, with overall cognizance being medium - room for further improvement. It is ar-

gued that medical personnel (and other professionals), notwithstanding concept recognition, as with nutritional management, may ignore or neglect skill development, so limiting confidence in its practical application.¹⁸ Likewise, mindful attention to the clinical evidence of nutrition risk and status may prohibit nutritional care.⁶⁻⁸ In the present report, critical care physicians have agreed on the value and effects of nutritional therapy (4.73±0.65), and acknowledge (some 95.7%) that it is necessary to strengthen its place in critical care. Indeed, 68.6% said that they would give educational priority to non-nutritional therapeutic measures, such as respiratory and circulatory treatment, in their clinical practice.

Nutritional therapy needs coherence, but is complex biomedically, socioculturally, environmentally and economically.¹⁹ This applies to risk assessment, initiation, pathway selection, energy, protein, other nutrient and bioactive requirement calculations, monitoring and optimization.¹⁹ We report five cognizant domains for clinician reflection, relevant to nutritional therapy. Among these domains, the average score for evaluation and monitoring of nutritional status was the highest 3.79±0.67 (*p*<0.01 with 3.0 as reference), that for understanding of nutritional preparations was the lowest 3.09±0.86 (*p*>0.05), and the average score for the other three dimensions was between 3.21 and 3.49. This enumeration of intensivist cognizance argues for protocols against which performance can be evaluated. In this way, it might be expected that nutritional would be minimised risk by optimization of metabolic health and clinical outcomes improved.^{14,20,21} It is a sine qua non that medical staff's understanding and practice of nutrition are pathophysiologically vital.

We have previously found that a factor in health care among provincial and county Guizhou hospitals is the ratio of ICU to other medical personnel.²² In parallel most secondary hospitals do not have professional nutrition technicians, and a small number of hospitals have not been able to implement the “All in One (AOI)” technology for parenteral nutrition.²³ It is, therefore noteworthy that we found 88.8% of physicians to suggest that diet prepared by the family of patients be preferred, and 58.4% to choose ordinary milk powder purchased by the family members in the market as an option for nutritional therapy. These views about nutritional therapy are likely to be predicated on socioeconomic and cultural context.

Limitations

This study adopts the method of field investigation, the process is rigorous, the sample size is sufficient, and the investigation tool has good reliability and validity through testing. However, as mentioned above, this study focuses on the investigation of intensivists’ subjective cognition of nutritional therapy and its influencing factors. Therefore, it needs to be comprehensively analyzed in combination with other aspects of clinical practice when using it for reference. In the future, we will also carry out an investigation on the actual clinical performance of physicians and the nutritional status of patients based on this result to further verify our research results.

Conclusions

Intensivists in Critical Care Medicine require a sound evidence-based cognizance of the place, methods, tools, and strategies for effective nutritional management of the seriously ill. For these competencies to be realised, early career and CNE and training are required. Yet this is unlikely to be enough unless multidisciplinary team work is practiced, and it is intrinsic to health system policy.

Knowledge of nutritional therapy is not comprehensive or adequate sufficient, especially in the understanding and use of nutritional preparations; Nutritional support is a continuous and dynamic process, and the standardization of nutritional support is restricted by the cognitive differences of physicians in each link. In the future, the continuing education of intensivists should not only emphasize the comprehensiveness and importance of nutritional management, but also encourage them to cooperate with dietitians to promote the development of protocols and standardization of therapy.

AUTHOR DISCLOSURES

The authors declare no conflict of interest.

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Supplementary table 1. Survey instrument

Nutritional management research (42 questions)

1). General information (8 questions)

1. Gender:
2. Age:
3. Education background:
4. Professional title:
5. How many years have you worked in critical care medicine?
6. When was your department established?
7. What is the level of your hospital?
8. Do you think that standardized nutritional support therapy is helpful to improve outcome for severely ill patients?

2). Nutrition management related situation and influencing factors (3 questions, Multiple choice)

9. What do you think hinders the popularization of nutritional therapy?
 - Doctors do not understand the importance of nutritional support
 - Doctors focus on or learn about other treatments as the priority
 - Doctors do not know about nutritional support management
 - Specific enteral nutrition preparations are not available in the ICU†
 - Local health insurance policies restrict access to nutritional treatment
 - Other reasons, please explain:
10. What approaches do you think could help increase awareness and initiation of nutritional support in ICU care?
 - Strengthen the evidence-based knowledge of nutrition support in the training of medical staff
 - Emphasize nutritional support as important as any other treatment modality
 - Educate patients and their families to know about and expect nutritional support therapy where appropriate
 - Make enteral nutrition preparations readily available
 - Include nutritional management in local health insurance policies
 - Other reasons, please explain:
11. What nutritional preparations do you use for enteral nutrition support in the ICU where you work?
 - Medical enteral nutrition preparations
 - Medical enteral nutrition suspension
 - Whole protein enteral nutrition powder
 - Enteral nutrition powder for special medical purposes
 - Ordinary milk powder purchased in the market
 - Rice cereal purchased in the market
 - "Diet" made by family members of patients
 - Other preparations or products , please explain:

3). Scales (31 questions, the options for each topic were divided into 5 levels, with 3 or more being a pass.)

(i) Cognizing and learning about nutrition

Option (1-5)

12. Do you understand some of the concepts/terminology of nutritional support therapy for critically ill patients?
13. Do you know about nutrition-related associations?
14. Are you aware of ICU-acquired weakness?
15. Have you received any education related to nutritional support therapy?
16. Are you willing to participate in professional training in nutritional support therapy?

(ii) Timing and principles of nutritional support

Option (1-5)

17. Do you understand the relevance of "Early Enteral Nutrition"?
 18. Do you know about the methods of enteral nutrition support?
 19. Do you know about the contraindications of nutritional support therapy?
 20. Do you know about the relative contraindications of nutritional support treatment?
 21. Do you appreciate how tolerance of damaged organ tolerance affects nutritional support for critically ill patients?
 22. Do you recognise that nutritional support requires differentiated treatment by underlying disease specificity?
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Supplementary table 1. Survey instrument (cont)

Nutritional management research (42 questions)	
(iii) Evaluation and monitoring of nutritional status	Option (1-5)
23. Do you screen ICU patients for nutritional status?	
24. Do you check relevant nutritional indicators before implementing nutritional support therapy?	
25. Do you monitor patient nutritional indicator changes during nutritional support therapy?	
26. Do you assess patients daily for the need for initiation of nutritional support?	
27. Do you know the clinical manifestations of intolerance during enteral nutrition support?	
28. Do you know the adverse reactions of parenteral nutrition support?	
(iv) Energy and protein requirements	Option (1-5)
29. Do you calculate the patient's target energy value when you give nutritional support to the patient?	
30. Do you know the preferred or optimal ratio of glucose and fat during parenteral nutrition support?	
31. Do you consider the required configuration of the energy: nitrogen ratio for parenteral nutrition support?	
32. Do you know how to arrive at the daily protein supply for parenteral nutrition?	
(v) Knowledge of nutritional support preparations	Option (1-5)
33. Are you aware of "Nutritional preparations for special medical purposes"?	
34. Do you know about the use of "medical enteral nutrition preparations"?	
35. Do you know what nutrients should be provided in parenteral nutrition support?	
36. Do you know the "All in One" technique of parenteral nutrition infusion?	
37. Do you know about the pharmacological effects of fat emulsions in parenteral nutrition preparations?	
38. Do you know how to use fat emulsions in parenteral nutrition?	
39. Do you know about the adverse effects of fat emulsions in parenteral nutrition?	
40. Do you know about the pharmacological effects of vitamins and trace elements in parenteral nutrition preparations?	
41. Do you know about the usage of vitamins and trace elements in parenteral nutrition preparations?	
42. Do you know the possible side effects of vitamins and trace elements in parenteral nutrition?	

ICU: intensive care unit.