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# Adherence to Guidelines on Nutritional Support by Medical Residents in an Intensive Care Unit in China: A Prospective Observational Study

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Data Collection B  
Statistical Analysis C  
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**Background:** The use of evidence-based clinical practice guidelines improves the quality of patient medical care. Although the implementation of clinical guidelines can be a challenge, nutritional support is important for critically ill patients. This prospective observational study aimed to investigate the attention to and implementation of guidelines for nutritional support in an Intensive Care Unit (ICU) in China and to identify factors that determine attention to these guidelines.

**Material/Methods:** The study included 16 medical residents who were interviewed while working in an emergency Intensive Care Unit (ICU) during one month. A structured interview questionnaire on attention to patient nutritional guidelines was used. Interviews were conducted daily after an early ICU ward round, and residents were asked questions regarding each patient.

**Results:** The response rate from medical residents was 99.6% (455/457). The rate of attention to and implementation of nutritional support guidelines was 57.1% (260/455) and 73.1% (334/457), respectively. Multivariate logistic regression analysis showed that weekdays and weekends (OR, 0.59; 95% CI, 0.38–0.91), medical groups (OR, 0.67; 95% CI, 0.46–0.98), and the numbers of patients admitted (OR, 0.91; 95% CI, 0.85–0.97) were independently associated with attention to nutritional support guidelines by the residents.

**Conclusions:** Nutritional guidelines for patients in the ICU were not fully paid attention to by medical residents or implemented. The reasons included high work demands and lack of standardized training. Further studies are needed to determine whether measures to reduce workload and improve medical training can improve adherence to nutritional support guidelines in the ICU.

**MeSH Keywords:** **Guidelines as Topic • Intensive Care Units • Nutritional Support**

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## Background

Clinical practice guidelines have been developed to improve the quality of care for patients. Adherence to clinical guidelines are critical to improving the quality of medical care. However, adherence to evidence-based clinical guidelines remain a challenge [1–4]. In the Intensive Care Unit (ICU), where the care needs of patients can be complex, evidence-based consensus guidelines have been developed. However, studies have shown that clinical guidelines are not always adhered to by health-care workers, and compliance with guidelines can vary [5].

Nutritional support is important for critically ill patients who are cared for in the ICU. However, even though clinical guidelines may not reflect daily practice, identification of factors that limit implementation may be a step towards improvement in patient care, including improvements in patient nutrition. Patient nutrition in the ICU may be overlooked when there are more immediate life-threatening conditions that require medical attention. The high medical workload for medical residents can affect the use of nutritional support guidelines. However, to our knowledge, there have been few previous studies on the factors that influence this important aspect of clinical practice.

There is a need for increased understanding regarding decisions made by medical staff in the ICU. Therefore, this prospective observational study aimed to investigate the attention of medical residents to nutritional support guidelines and the implementation of the guidelines in an Intensive Care Unit (ICU) in China and to identify factors that determine attention to these guidelines.

## Material and Methods

### Settings and participants

This prospective observational study was approved by the Ethics Committee of the Second Affiliated Hospital of Zhejiang University School of Medicine and was conducted in accordance with approved guidelines. All study participants provided written informed consent. The study was conducted in a 16-bed emergency Intensive Care Unit (ICU) during one month, from January 2, 2018, to February 1, 2018. The annual admission of the ICU reached 900 patients, the patient survival rate was 87%, the average length of stay was 6.12 days. Common indications for admission to the ICU were road traffic accidents, falls, infection, and respiratory illness.

There were two medical groups (Group 1 and Group 2) in the ICU. Each group included one attending physician and eight medical residents. The attending physician in Group 1 was an expert in nutrition, and the attending physician in Group 2 was

a trauma specialist. Each group was responsible for eight beds. On weekdays, one resident was responsible for one ICU bed, with a medical resident to patient ratio of 1: 1. On weekends, when only two medical residents were working, each was responsible for eight ICU beds, with a medical resident to patient ratio of 1: 8.

Multidisciplinary rounds in Group 1 and Group 2 were led by the attending physician and included medical residents from surgical, anesthesia, and emergency medicine programs, the ICU nurse, the unit charge nurse, a respiratory therapist, and medical students. Medical residents were studied in the ICU because they represented the first-line physicians responsible for the patients. Data on demographic characteristics of the residents, including age, gender, educational status, primary medical specialty, and the number of years of experience, were collected. Details of consecutive cases admitted to the ICU, except for patients admitted for <24 hours, were also recorded.

### Data collection

According to evidence-based guidelines in the field of critical care medicine, nutritional support was identified as an important aspect of patient care [6,7]. A written questionnaire was developed based on the current guidelines for patient nutritional support and included two main questions. The first question was: *Is the patient on enteral or parenteral nutrition?* The second question was: *Have you paid attention to nutrition assessment and support in any way during early ward rounds?*

The study investigators conducted the following two phases of the study after the daily ward round. In Phase 1, interviews were performed with the medical residents regarding attention to nutritional support guidelines for an individual patient. One interview for each medical resident was conducted per patient per day. Medical residents were given a detailed subject information statement before the interview, and completion of the interview implied consent to participate. Completion of the interview took approximately 2–3 minutes. No interviews were conducted with the patients in the ICU, as they were severely ill.

In Phase 2, interviews were conducted at around noon after the Phase 1 daily interview. The investigator judged and recorded whether or not the proper implementation of nutritional assessment and support for an individual patient was conducted. The nutritional assessment requirements included initiating, formulating, dosing, and monitoring the tolerance and adequacy of enteral nutrition, and initiating and maximizing the efficacy of parenteral nutrition [6]. In cases of disagreement during the assessment, expert consensus was involved. The roles of the attending physicians were not analyzed, as they were not first-line in the ICU, and only two were present in this study.

**Table 1.** Characteristics of the medical residents included in the study (N=16).

Characteristics	Total n=16	Medical resident Group 1 n=8	Medical resident Group 2 n=8	P-value*
Male (%)	10 (62.50%)	5 (62.50%)	5 (62.50%)	1.00
Age	30.6±6.7	29.9±6.6	31.4±7.2	0.67
Years of experience (>2 years)	7 (43.75%)	3 (37.50%)	4 (50.00%)	0.5
Intensivist (%)	11 (68.75%)	4 (50.00%)	7 (87.50%)	0.09

\* P-value, comparison between the two groups.

### Data analysis

There were too few previously published studies to help to determine the adequate study sample size. Data on gender, age ( $\geq 60$  years or  $< 60$  years), trauma (yes or no) were expressed as a ratio or rate. Quantitative data, including age, and the Acute Physiology, Age, Chronic Health Evaluation II (APACHE-II) score were expressed as the mean±standard deviation or median and quartile, according to whether the data were normally distributed. The chi-squared  $\chi^2$  test or Fisher's exact test were used to compare the composition ratios or rates, and Student's t-test or the Mann-Whitney U test were used to compare the means or medians. We assumed that the workload of the medical residents affected the ability to pay attention to the nutritional support guidelines. Multivariate logistic regression analysis was conducted to determine the influencing factors, including weekdays compared with weekends, medical resident Group 1 and Group 2, and the numbers of patients admitted to the ICU. Data were analyzed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). A two-tailed  $P < 0.05$  was considered statistically significant. The repeat interviews in the same resident were deemed independent.

### Results

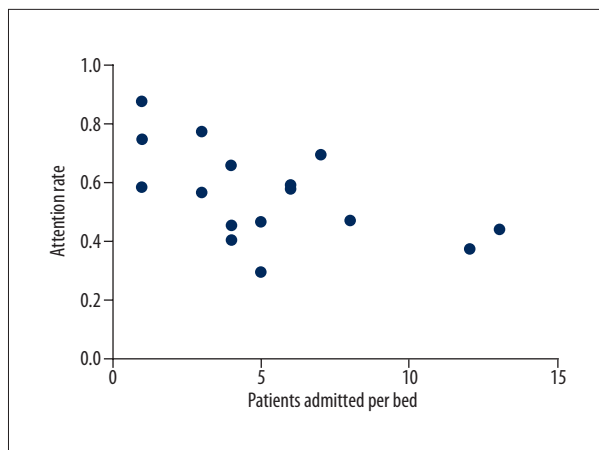
All 16 residents from the two medical groups (100%) were interviewed. Their characteristics are summarized in Table 1. There were no significant differences between Group 1 and Group 2. Of the 457 interviews that were conducted with the medical residents, 455 interviews were conducted successfully, with a response rate of 99.6%. Of the 455 interviews with the medical residents, 260 responses supported that the medical residents had paid attention to nutritional support guidelines during daily ward rounds, with an attention rate of 57.1% (260/455). Of the 457 inspections by investigators at noon, 334 showed that nutritional support guidelines for an individual patient had been properly implemented, with the rate of implementation of nutritional support guidelines of 73.1% (334/457).

**Table 2.** Characteristics of the patients included in the study (N=79).

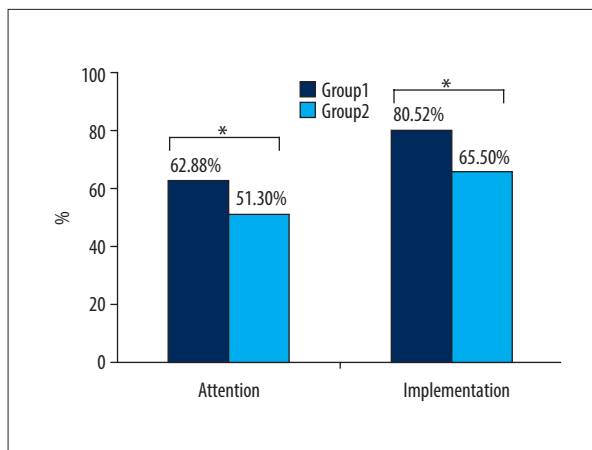
Characteristics	Total
Average length of stay in ICU (days)	5.72
Patients studied	79
Male (%)	57 (72.20%)
$\geq 60$ year (%)	44 (55.70%)
APACHE-II score	16.32±8.80
Trauma	44 (55.70%)
Traffic accident	29
Falling accident	7
Others	8
Non-trauma	35 (44.30%)
Toxicity	4
Sepsis	6
AECOPD	5
Pneumonia	9
Post-operative	5
Other	6

ICU – Intensive Care Unit; APACHE-II – acute physiology, age, chronic health evaluation II; AECOPD – acute exacerbation of chronic obstructive pulmonary disease.

During the study period, a total of 79 patients were admitted to the ICU, including 42 in the medical Group 1, and 37 in the medical Group 2. The characteristics of the included patients were shown in Table 2. The average Acute Physiology, Age, Chronic Health Evaluation II (APACHE II) score was 16.32. The average length of stay was 5.72 days, and the number of patients admitted per bed ranged from 1–13, with an average



**Figure 1.** Correlation between the admitted patients per bed and the rate of attention to nutritional guidelines. Each dot represents a bed.



**Figure 2.** Comparison of the attention to and implementation of nutritional guidelines between medical residents in Group 1 and medical residents in Group 2.

**Table 3.** Factors that influenced attention to clinical guidelines for nutritional support from the medical residents.

	P-value	Odds ratio (OR)	95% CI
Weekends	0.016	0.59	0.38, 0.91
Medical group 2	0.038	0.67	0.46, 0.98
Number of patients admitted	0.005	0.91	0.85, 0.97
Constant	0.000	5.27	

The odds ratio (OR) value between weekend day and working day=0.59. The OR value between medical resident Group 2 and medical resident Group 1=0.67.

of 5.19. As shown in Figure 1, the more patients the resident was responsible for, the lower the resident’s attention rate was ( $r=-0.54$ ;  $P=0.03$ ).

A total of 21 weekdays and 10 weekend days were counted during the study period. The rate of attention to nutritional support guidelines by residents was significantly lower on weekends than on weekdays (46.83% vs. 63.19%;  $P<0.05$ ). However, no significant difference in the rate of nutrition implementation guidelines was identified between weekends and weekdays (73.02% vs. 71.20%;  $P>0.05$ ).

As shown in Figure 2, the rates of attention to and implementation of nutritional support guidelines were consistent in medical Group 1, where both attention to and implementation of nutritional support guidelines were higher than those of the medical Group 2 (62.88% vs. 51.30% for attention) ( $P<0.05$ ) (80.52% vs. 65.50% for implementation) ( $P<0.05$ ).

Multivariate logistic regression analysis of the factors influencing the rate of paying attention to nutritional support guidelines by medical residents, including weekends/weekdays, medical group, years of experience (>2 years or ≤2 years), resident

specialties, and the number of admitted patients were used as independent variables. The results shown in Table 3 indicate that the factors that significantly affected the attention to nutritional support guidelines included weekends/weekdays (OR, 0.59; 95% CI, 0.38–0.91), the medical group (OR, 0.67; 95% CI, 0.46–0.98) and the number of patients admitted to the ICU (OR, 0.91; 95% CI, 0.85–0.97).

## Discussion

Despite the rise in evidence-based medicine and the existence of clinical practice guidelines of proven utility, the use of these guidelines in daily clinical practice is still limited. Little is known about the factors that improve medical adherence to clinical guidelines [4]. In the present study, multivariate logistic regression analysis showed that a high workload appeared to reduce paying attention to nutritional support guidelines by medical residents who were working in an Intensive Care Unit (ICU) in China.

The rate of paying attention by medical residents to nutritional support guidelines was lower on the weekends than on weekdays, possibly because of the lower staffing levels of

medical residents in the ward on weekends. Only two residents worked on the weekends, and one was responsible for eight beds in medical Group 1. Therefore, the workload was much greater than that on weekdays. Additionally, as shown in Figure 1, the more patients the resident was responsible for, the lower their attention rate. Feedback following the interviews in this study suggested that when residents were busy with more patients who had immediate and life-threatening problems, nutrition management was more easily overlooked.

This study found that the rate of attention to nutritional support guidelines of the medical residents in Group 1 was consistent with the nutrition implementation rate in the same group, and both were higher than those of medical Group 2. The possible reason was that the attending physician in Group 1 was an expert in nutrition and therefore paid more attention to nutritional support, which affected the rate of attention to nutritional guidelines by the residents in the same group and further affected implementation of nutritional support. This finding indicated that the senior doctors had a significant impact on both young doctors and patient care. Therefore, the standardized medical practice and medical training are critical to ensure adherence to clinical guidelines.

Implementation of clinical guidelines is a multidisciplinary task. Paying attention to guidelines by caregivers, including residents, nurses, attending physicians, and dietitians, collectively contributed to the implementation of guidelines [8,9]. Therefore, as shown in this study, there may be some inconsistencies between the rate of attention of medical residents to nutritional guidelines and the rate of implementation. The findings from this study reflected paying attention to nutrition in patients in the ICU by medical residents. However, their responses to the questions about their views did not directly reflect what was actually done at the bedside. As an example, most healthcare workers are aware that the most effective way to prevent cross-infection is with hand washing, but they do not all do this in clinical practice. Our findings confirmed that published guidelines alone could not be expected to change clinical practice at the bedside. The practice patterns of physicians and how to change them had been the subject of previous research [10]. However, by not considering a variety of factors, interventions to improve adherence were less likely to be successful. This study indicated that measures to reduce medical staff workloads and standardize the behavior of senior doctors might improve adherence to clinical guidelines.

The clinical checklist is a tool to standardize the behavior of medical staff. The findings from previous studies have shown that the introduction of a daily checklist significantly improved the compliance rates for clinical practices such as head-of-bed elevation, sedation holidays, and the use of prophylaxis for upper gastrointestinal bleeding [11,12]. However,

the long-term sustainability of improvement in adherence to guidelines remains an important concern [11]. Teixeira et al., in their two-year study, reported the results obtained using a checklist could be presented as a monthly report [12]. This cultural change not only motivated the daily use of the checklist but also provided an opportunity for the early identification of any areas in which compliance may have decreased, allowing for immediate corrective interventions [12].

There were some important considerations in the design of the present study. An interview was conducted, rather than an electronic mail (e-mail) survey, to investigate the attention to nutritional support guidelines, which assisted in improving the response rate and explored the factors affecting paying attention to the guidelines by medical staff in greater depth. Also, this study was implemented on consecutive days rather than on a single day to reflect nutritional management. However, this study had several limitations. This study was conducted at a single center and the study period was short, the number of medical residents (N=16) and the number of patients (N=79) were limited. Face to face interviews with medical residents about paying attention to clinical guidelines may not reflect what their perceptions really were. Also, the judgment time for implementation of nutritional support guidelines was only recorded at noon, which might not offer a representative picture of the situation throughout the whole day. There were too many confounding factors to analyze in the study that were related to the implementation of the guidelines. These factors included paying attention to guidelines by medical residents, nurses, attending physicians, and dietitians, as well as the severity of illness of the patients in ICU. Due to the short duration of the study and the small study sample size, we did not analyze the impact of implementation of nutritional support guidelines on patient outcome.

## Conclusions

The findings from this preliminary study in an Intensive Care Unit (ICU) in China showed that attention of medical residents to nutritional support guidelines as well as implementation of these guidelines was not satisfactory. High workload and the lack of standardized training were the main influencing factors. Further studies are needed to develop improvements in this area of clinical practice.

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## Conflict of interests

None.

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