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# Assessment of barriers to optimum enteral nutrition practices as perceived by critical care providers

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## Abstract

**Background** Nutritional support is a vital intervention for critically ill patients. Despite the existence of several clinical practice guidelines focused on enteral nutrition of critically ill, there is still a gap between guideline recommendations and actual nutrition practices. The purpose of this study is to understand the role of the clinical pharmacist in identifying the barriers to applying optimum enteral nutritional practices from the perspective of critical care providers. A descriptive cross-sectional design was utilized using self-administered questionnaire. A total of 90 critical care providers comprising of 3 categories: physicians (n = 30), clinical pharmacists (n = 30), and nurses (n = 30) were recruited. "The barriers to enteral feeding critically ill patients" questionnaire was used to explore the barriers that hinder them from optimal delivery of enteral nutrition.

**Results** Not enough dietitian coverage during holidays was the most important barrier facing the physicians. As for the clinical pharmacists, the most important barrier was waiting for the dietitian to assess the patient. Regarding the nurses, familiarity with nutrition guidelines was the most important barrier. There was a highly significant difference between physicians, clinical pharmacists, and nurses regarding subscales' scores and overall scores of Barriers Questionnaire except for the resources and provider attitudes.

**Conclusion** Barriers to optimum enteral nutrition practices were explored with more attention on barriers regarding dietitian support and critical care providers' attitudes. This article provides the basis for the creation of interventions intended to overcome these barriers and enhance enteral nutrition practices.

**Keywords** Enteral nutrition, Barriers, Critically ill, Critical care providers

## Background

Care for critically ill patients is considered a standard of care; they are hypermetabolic and have increased energy needs. For the critically ill, nutritional support is a vital aspect of care, considered historically as a supportive care's adjunct but more recently relocated as a therapeutic intervention [1–4].

Enteral nutrition (EN) is the most favored method of nutritional support for critically ill patients [5]. It improves clinical outcomes and reduces costs associated with treatment compared to parenteral nutrition [6].

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Providing that the nutritional support principles have been widely recognized and given significant priority to critically ill patients [4], and in spite of the fact that EN has been considered the basis standard for nutritional therapy in critically ill patients [7], where there are well recognized guidelines for the use of EN [8], yet there are still major global problems with insufficient enteral feeding where observational studies have repeatedly shown substantial gap between guideline recommendations and real nutrition practice [9–11]. Therefore, EN often fails to provide the necessary energy supplies that contribute to malnutrition [9], where multiple studies have shown that more than 35% of Intensive care unit (ICU) patients are malnourished [12, 13] and underfeeding is common in the ICU with patients receiving an average of only 60% of the calories that they are prescribed which rises their risk of infection, delays wound healing [10, 14], leads to extended hospital stay and is associated with higher medical costs [15].

Literature supports the need to recognize barriers that hinder the application of the optimum nutritional care practices, where understanding these barriers is crucial for critical care providers to improve nutritional support [16]. Consequently, protocols to overcome these barriers can be developed and implemented to optimize nutritional support [17].

Ideally, a multidisciplinary team called Nutrition Support Team (NST) consisting of a physician, clinical pharmacist, dietician, and nurse delivers EN to patients where they combine their efforts to optimize patients' care [18]. Guidelines, such as those developed by the European Society of Parenteral and Enteral Nutrition (E.S.P.E.N.) emphasize the importance of cooperation between health care providers including physicians, clinical pharmacists, nurses, dietitians, and kitchen staff [19].

Clinical Pharmacists are cornerstone members of the NST and can potentially contribute to the care of EN receiving patients [20], by bringing their unique knowledge of pharmacotherapeutic and pharmacokinetic principles to the field of nutritional support. Nutrition support clinical pharmacists offer a variety of valuable services related to EN, such as designing and implementing of personalized nutrition care plans, providing direct patient care, monitoring the response of the patient to EN, enhance patients' clinical outcomes and nutritional status, prevent and address EN-related problems, and achieve substantial cost savings [21, 22]. Therefore, EN offers a perfect chance for the clinical pharmacists to contribute as part of the NST in providing patients with safe and optimum nutrition care [23].

In view of the aforementioned trends, this study aimed at gaining a broad understanding of the role of the clinical pharmacist in identifying the barriers leading to

insufficient EN feeding in critically ill patients from the perspective of critical care providers so that subsequently interventions can be designated to overcome these barriers and enhance nutritional care.

## Methods

### Study design

A descriptive cross-sectional study was conducted between January and June 2019 to identify critical care providers' (i.e., physicians, clinical pharmacists, and nurses) barriers that impede them from applying optimum EN practices using a self-administered questionnaire. Trial registration: The trial was registered in ClinicalTrials.gov (NCT03698292).

### Setting and participants

The study was conducted in the ICU of Al Kasr Al Ainy hospital, Cairo, Egypt. Full time or part time critical care providers who met the eligibility criteria for the study that included: (1) being a registered physician, clinical pharmacist, or nurse. (2) having experience of working at least 3 months in the ICU, and (3) providing direct patient care were enrolled in this study giving a total of 90 participants. The study excluded critical care providers with administrative positions.

### Instrument

Barriers to optimum enteral feeding practices have been assessed using "Barriers to Enteral Feeding Critically-ill Patients" Questionnaire. This barrier applies to obstructive factors experienced by critical care providers when supplying patients with adequate EN. The questionnaire consisted of 20 items with stable structure by Cahill, Day, Cook, and Heyland [24]. The questionnaire was culturally adapted and translated into Arabic language since it is the native language of the Egyptian health care providers. The questionnaire in Arabic version which has been uploaded on the Canadian critical care nutrition website ([www.criticalcarenutrition.com](http://www.criticalcarenutrition.com)) was divided into 2 parts: Part A (Barriers to Delivery of Enteral Nutrition) and Part B (Personal characteristics). Part A asked respondents to assess the significance of potential barriers to supplying enteral nutrition to patients on a 7-point Likert scale of 'not at all' to 'an extreme amount'. Part A has four subscales and 20 items, including delivery of enteral nutrition to the patient (7 items), Dietitian Support (4 items), ICU resources (2 items), as well as critical care provider attitudes and behavior (7 items). Scores of 0–6 were used to determine the barrier degree level in Likert 7-level grading method; 0 meaning no barrier, and 6 meaning severe (seriously affecting EN supply). The questionnaire has favorable reliability and validity, where previous publications have shown that construct validity,

internal reliability and content of the instrument were suitable [16].

**Ethical considerations**

Before beginning the study, permission to use the questionnaire was obtained from the copyright holder. Informed consent was obtained from all subjects prior to participation in the study and participants were ensured that their responses were confidential.

The ethical approval for both the scientific and the ethical aspects to conduct the study was obtained from the committee of Ethics of Faculty of Pharmacy, Ain Shams University and the research ethics committee for experimental and clinical studies at faculty of Pharmaceutical Sciences and Pharmaceutical Industries, Future University, New Cairo, Egypt. The study was registered in ClinicalTrials.gov (NCT03698292).

**Data collection**

In this study, critical care providers who met the eligibility criteria and were willing to participate were included in the study. After reading the cover letter of the questionnaire and signifying an understanding of the purpose of the study, participants were invited to complete the questionnaire. The primary researcher was available to answer every question. They were given 10 min to answer the questionnaire, and then return it to the researcher.

**Data management and analysis**

The data collected have been revised, coded, tabulated, and added to a PC using Statistical package for Social Science ((IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp). Data was presented and the appropriate analysis was performed for each parameter according to the type of data obtained. For descriptive statistics, with the Kolmogorov–Smirnov test, data were checked for normality and expressed as mean ( $\pm$  standard deviation) for numerical parametric data and frequency and percentage for non-numerical data. ANOVA test was used to assess the statistical significance of the difference between more than two study group means.

**Sample size justification**

Sample size was calculated using PASS program, setting the type-1 error ( $\alpha$ ) at 0.05 and confidence interval with a width equal to 0.15. Result from previous study that 11.5% of health care workers reported that “No or not enough dietitian coverage during evenings, weekends and holidays” as a barrier for effective enteral nutrition practices. Based on this, the minimum required sample size was 70 nurses [25]. However, a larger sample size

(90) was targeted to compensate for incomplete questionnaires and possible dropout rates.

**Results**

A total of 90 completed questionnaires were received (30 physicians, 30 clinical pharmacists and 30 nurses).

**Demographic characteristics of the participants**

Table 1 showed the demographic characteristics of the studied participants of the three categories. There was no significant difference between the three categories regarding demographics.

**Enteral feeding barrier score of ICU patients**

The barriers questionnaire consisted of 20 barriers, divided into 4 subscales. As seen in Table 2, the overall mean scores were ( $65.13 \pm 11.33$ ), ( $71.83 \pm 10$ ) and ( $70.90 \pm 8.55$ ) for the physicians, clinical pharmacists, and nurses, respectively.

**Delivery of enteral nutrition to the patient**

Table 2 showed critical care providers’ responses towards the Barriers questionnaire items; for the delivery of enteral nutrition subscale, the sixth barrier showed the highest mean score for both the physicians’ and clinical pharmacists’ responses with mean scores of ( $4.27 \pm 2.02$ ) for the physicians and ( $4.5 \pm 1.76$ ) for the clinical pharmacists, while the fourth barrier had the lowest mean score in this subscale for the physicians ( $0.83 \pm 0.9$ ) and the second barrier was the lowest barrier as per the clinical pharmacists’ responses ( $0.9 \pm 1.3$ ). Whereas the nurses recorded the highest mean scores for the fourth barrier

**Table 1** Description of socio demographic characteristics among studied physicians, clinical pharmacists, and nurses

	Physicians	Clinical pharmacists	Nurses
<i>Age, N (%)</i>			
34 years or less	13 (43.3%)	23 (76.7%)	13 (43.3%)
35–49	13 (43.3%)	7 (23.3%)	16 (53.3%)
50–64	4 (13.3%)	0 (0%)	1 (3.3%)
<i>Gender, N (%)</i>			
Male	14 (46.7%)	5 (16.7%)	13 (43.3%)
Female	16 (53.3%)	25 (83.3%)	17 (56.7%)
<i>Experience years, N (%)</i>			
0–5 years	7 (23.3%)	24 (80%)	7 (23.3%)
6–10 years	14 (46.7%)	6 (20%)	10 (33.3%)
11–15 years	5 (16.7%)	0 (0%)	9 (30%)
> 15 years	4 (13.3%)	0 (0%)	4 (13.3%)
<i>Employment status, N (%)</i>			
Full-time	23 (76.7%)	22 (73.3%)	23 (76.7%)
Part-time	7 (23.3%)	8 (26.7%)	7 (23.3%)

**Table 2** Description of critical care providers' response as regard enteral nutrition to the Patient

Items of the Barriers to enteral feeding questionnaire	Critical care providers		
	Physicians, mean, (S.D)	Clinical pharmacists, mean, (S.D)	Nurses, mean, (S.D)
<i>A. Delivery of enteral Nutrition to the patient</i>			
1. Delay in physicians ordering the initiation of EN	1.67, (1.94)	3.83, (1.78)	0.87, (1.14)
2. Waiting for physician/radiology to read x-ray and confirm tube placement	1.33, (1.75)	0.90, (1.30)	3.3, (2.09)
3. Frequent displacement of feeding tube, requiring reinsertion	1.50, (1.33)	1.80, (1.37)	2.20, (1.54)
4. Delays in initiating motility agents in patients not tolerating enteral nutrition (i.e., high gastric residual volumes)	0.83, (0.91)	4.23, (1.87)	4, (2.1)
5. Delays and difficulties in obtaining small bowel access in patients not tolerating enteral nutrition (i.e., high gastric residual volumes)	2.03, (1.67)	1.70, (1.34)	1.93, (1.44)
6. In resuscitated, hemodynamically stable patients, other aspects of patient care still take priority over nutrition	4.27, (2.02)	4.50, (1.76)	3.73, (2.02)
7. Nutrition therapy not routinely discussed in patient care rounds	4.10, (1.56)	4.03, (2.22)	3.7, (1.62)
Total score of "Delivery of Enteral Nutrition"	15.73, (5.08)	21, (5.69)	19.73, (5.91)
<i>B. Dietitian Support</i>			
1. Waiting for the dietitian to assess the patient	4.83, (1.44)	5.38, (0.86)	5.6, (0.97)
2. Dietitian not routinely present on weekday patient rounds	5.03, (1.3)	5.23, (1.28)	5.7, (0.65)
3. No or not enough dietitian coverage during evenings, weekends, and holidays	5.07, (1.31)	5.27, (1.28)	5.8, (0.41)
4. Not enough time dedicated to education and training on how to optimally feed patients	4.23, (1.92)	4.30, (1.51)	5.8, (0.41)
Total score of "Dietitian Support"	19.17, (4.64)	20, (3.87)	22.9, (1.83)
<i>C. ICU Resources</i>			
1. Enteral formula not available on the unit	3.43, (1.7)	3.37, (1.97)	1.53, (1.96)
2. No or not enough feeding pumps on the unit	4.5, (1.72)	4.3, (1.68)	4.83, (1.68)
Total score of "ICU Resources"	7.93, (2.61)	7.67, (2.66)	6.37, (2.58)
<i>D. Critical Care Providers' attitudes and behavior</i>			
1. Non-ICU physicians (i.e., surgeons, gastroenterologists) requesting patients not be fed enterally	4.8, (1.47)	4.53, (1.59)	2.67, (2.17)
2. Nurses failing to progress feeds as per the feeding protocol	4.03, (1.35)	3.23, (1.74)	0.87, (0.94)
3. EN being held due to diarrhea	2.63, (1.54)	3.67, (1.71)	2.07, (1.62)
4. Fear of adverse events due to aggressively feeding patients	1.1, (1.47)	1.83, (1.84)	0.87, (1.22)
5. Feeding being held too far in advance of procedures or operating room visits	4.73, (1.64)	4.8, (1.56)	5.43, (1.14)
6. Lack of familiarity with current guidelines for nutrition in the ICU	3.7, (1.82)	1.03, (1.88)	5.93, (0.25)
7. General belief among ICU team that provision of adequate nutrition does not impact on patient outcome	1.3, (1.29)	4.07, (1.7)	4.07, (1.76)
Total score of "Critical Care Providers' Attitudes"	22.3, (4.21)	23.17, (4.59)	21.9, (4.13)
Overall score	65.13, (11.33)	71.83, (10)	70.9, (8.55)

( $4 \pm 2.1$ ) and the lowest for the first barrier in this subscale ( $0.87 \pm 1.14$ ).

#### Dietitian support

The major barrier reported by both the physicians and nurses in this subscale was the third barrier with mean scores of ( $5.07 \pm 1.31$ ) and ( $5.8 \pm 0.4$ ) for both the physicians and nurses, respectively. While the clinical pharmacists reported that the first barrier was the major barrier ( $5.38 \pm 0.86$ ). The lowest mean scores in this subscale were for the fourth barrier as reported by the physicians ( $4.23 \pm 1.92$ ) and clinical pharmacists ( $4.3 \pm 1.5$ ), while the

nurses reported that the first barrier was the least important one in this subscale ( $22.9 \pm 1.83$ ).

#### ICU resources

The 3 categories reported that the major barrier in this subscale was the second barrier with the highest mean scores of ( $4.5 \pm 1.72$ ), ( $4.3 \pm 1.68$ ) and ( $4.83 \pm 1.68$ ) for the physicians, clinical pharmacists, and nurses, respectively. The lowest mean scores were for the first barrier ( $3.4 \pm 1.7$ ) for the physicians, ( $3.37 \pm 1.97$ ), the clinical pharmacists and for the nurses ( $1.53 \pm 1.96$ ).

**Critical care providers’ attitudes**

The first barrier in this subscale was the major barrier reported by the physicians with mean score of  $(4.8 \pm 1.47)$ . The highest score barrier reported by the clinical pharmacists in this subscale was for the fifth barrier  $(4.8 \pm 1.56)$  and as for the nurses, the sixth barrier was the major barrier  $(5.93 \pm 0.25)$ . The least important barriers were the fourth barrier as per the physicians’ and nurses’ responses with mean scores of  $(1.1 \pm 1.47)$  and  $(0.87 \pm 1.2)$  respectively and the sixth barrier for the clinical pharmacists  $(1.03 \pm 1.8)$ .

**Other barriers**

Some barriers were reported by the participants other than those in the Barriers questionnaire. Half of the physicians reported that not having enough nursing staff to deliver EN was an essential barrier. The majority of the clinical pharmacists (76.7%) reported that not knowing

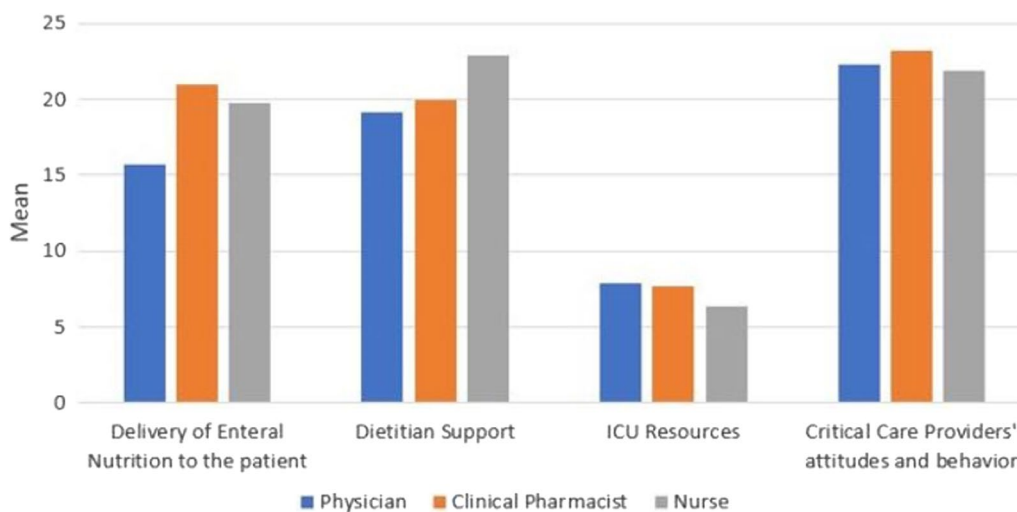
the caloric content of the feed was an important barrier and more than half of them (60%) reported another barrier which was poor communication between ICU staff regarding nutrition which was also reported by (66.7%) of the nurses. Moreover, 60% of the nurses added that the poor quality of feed as well as poor storage conditions were other barriers to optimum EN delivery to critically ill patients.

By comparing between critical care providers regarding subscales’ scores and overall scores of Barriers Questionnaire, Table 3 showed that there was a highly significant difference between nurses, physicians and clinical pharmacists regarding subscales’ scores and overall scores of Barriers questionnaire with the exception of ICU resources and critical care providers’ attitudes (Fig. 1).

**Table 3** Comparison between nurses, Physician and clinical pharmacists as regard subscales’ scores and overall scores of Barriers Questionnaire

	Critical care providers						P*
	Physician		Clinical pharmacist		Nurse		
	Mean	± SD	Mean	± SD	Mean	± SD	
Delivery of Enteral Nutrition to the patient	15.73	5.08	21	5.69	19.73	5.91	0.001
Dietitian support	19.17	4.64	20	3.87	22.9	1.83	0.001
ICU resources	7.93	2.61	7.67	2.66	6.37	2.58	0.051
Critical care providers attitudes and behavior attitudes	22.3	4.21	23.17	4.59	21.9	4.13	0.511
Overall score	65.13	11.33	71.83	10.03	70.9	8.55	0.023

\* ANOVA



**Fig. 1** Description of critical care providers’ response as regard enteral nutrition to the patient

## Discussion

Understanding EN barriers is necessary for improving critical care providers' practices and achieving optimal EN. Since barriers to EN are multifactorial, it is of great importance to identify specific barriers [25].

Unfortunately, clinical pharmacists have been provided fewer coverage relative to other health care providers such as dietitians, nurses, and physicians in most of the published research on attitude and knowledge concerning nutritional care support [26–28]. To the best of our knowledge, this is the first study of clinical pharmacists' attitude towards nutrition and the barriers they face in feeding patients who are critically ill.

This study evaluated the critical care providers' perceived EN barriers. In Delivery of EN to the patient subscale, both physicians and clinical pharmacists responded giving the highest mean score for "In resuscitated patient, other aspects take priority over nutrition" barrier, and came as the second barrier of importance in this subscale as per the nurses' responses which came in agreement with the results of another survey where the same barrier was reported as the highest barrier for enterally fed critically ill adult patients from the point of view of nurses [25] and also similar to the results of the study of Darawad et al. [29]. This reflects the complicated responsibilities of the ICU environment, inadequate staffing, and high workload, where compared to other tasks, patient feeding becomes a secondary priority. Having negative perceptions of the importance of enteral feeding and the low priority of this care leads to predisposing critically ill patients to malnutrition. As nutritional support in critical care units is viewed as a low priority, the provision of nutritional guidelines and protocols should therefore be mandatory [29]. Also, in this subscale nurses reported that the most important barrier was delay in initiating and giving motility agents and this came in agreement with Cahill et al. where nurses reported that this item was one of the most important barriers [25].

The highest mean scores in this study were for the "Dietitian Support" as well as "Critical Care providers' attitudes" for the three categories of critical care providers, where "Dietitian Support" subscale's overall mean scored the highest from the nurses' perspective, this result was consistent with the literature in which "Dietitian Support" and "the Delivery of Enteral nutrition" scored the highest on barriers' subscales [25]. In this subscale, unavailability of dietitians in holidays or waiting for the dietitian to assess the patients were important barriers as reported by the respondents. Cahil et al. [25] previously reported this variable as one of their study's 10 most common variables. Although nutritional support is a collaborative task, and the availability of dietitians is crucial for providing safe and effective nutritional care practices [30].

However, Dietitians do not seem to have devoted enough time to discuss the concerns of individualized patients' problems even if they were available in ICU.

In the ICU resources subscale, the unavailability of pumps was the major barrier facing the critical care providers. The use of enteral feeding pumps is now a standard procedure for patients who need assistance meeting nutritional requirements and is now known to be the most effective means of providing enteral feeding across all patient groups and care settings [31], their unavailability hinders patients' optimal supply of EN [32].

Regarding the "Critical Care Providers' attitudes" subscale, EN interruptions either due to non-ICU physicians requesting to stop EN or holding of EN prior procedures were the two major barriers as reported by the physicians and the clinical pharmacists, respectively. For critically ill patients, EN is usually delayed until acute medical issues are stabilized; for days, it is often not started or restarted [33]. Similarly, EN was disrupted in critically ill patients in several studies [34, 35]. Additionally, some studies have resulted in patients receiving just 50% to 76% of the energy needed in the studies [33, 35, 36]. Most feeding interruptions occur because of bedside and operating rooms' procedures and tests. McClave et al. reported that procedures have resulted in the longest cessation of enteral nutrition, accounting for 35% of the interruption time [37].

Also, in the critical care providers' attitudes subscale, unfamiliarity of the nutrition guidelines was reported as the most important barrier as perceived by nurses. Several studies have indicated that although nutrition is a significant concern in hospitals, little attention has been paid to the way nurses administer enteral feeding [2, 38]. There are wide variations in nutritional support management that may be related to knowledge gaps or to a lack of knowledge of the recent nutritional guidelines [39]. Therefore, approaches to increased awareness among all ICU team members of the evidence that supports guideline recommendations for better outcomes as lack of knowledge of guidelines may affect practice [40]. Furthermore, participants have also reported no education or training on nutrition as an important barrier where minority of them confides that they are receiving nutrition therapy training at their hospital. In fact, there are numerous methods to challenge these issues. Primarily, by introducing well-developed advanced nutritional care curricula at both the undergraduate and the postgraduate level to enhance the nutritional science and improve clinical practice. In addition to all of that, these problems can be solved by introducing a continuous clinical training program specifically on nutrition support, which can ensure that critical care providers are up to date with

current knowledge and the latest nutrition guidelines [41, 42].

Concerning the barriers reported by the providers other than those mentioned in the questionnaire; poor Communication between ICU staff was reported by nurses as one of the important barriers that hinders implementation of optimal nutrition therapy. These results came in agreement with another study that stated that lack of communication between the ICU members led to delays in EN initiation and progress [29]. Another barrier reported by physicians was "insufficient nursing to deliver nutrition" which was similar to the results reported by another study [25] where it was the highest score barrier.

By identifying the important barriers to applying optimal enteral feeding practices in critically ill patients, clinical pharmacists have demonstrated their beneficial role in NST, the next step is to link or customize interventions to avoid these barriers.

## Conclusion

In this study, many significant barriers to the adequate delivery of EN to critically ill patients have been highlighted by the clinical pharmacist, providing a better understanding of the modifiable challenges facing critical care providers when delivering optimal EN to critically ill patients and pointing out some of the factors that contribute to the observed gap between recommendations of nutrition guidelines and real practice. Overcoming these defined barriers may be a successful strategy to enhance the practice of nutrition and close the gap between guidelines and real practice. More clinical studies are required to determine the barriers to enteral feeding in different populations and the optimal protocols to overcome these barriers.

## Abbreviations

EN	Enteral nutrition
ICU	Intensive care unit
NST	Nutrition support team
ESPEN	European society of enteral and parenteral nutrition

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## Author contributions

EE—collected data, analyzed data, wrote manuscript. MH—performed power calculations, participated in the design of the study, critical revision of the manuscript. ED—participated in the design of the study, critical revision of the manuscript. AB—critical revision of the manuscript. NS—participated in the design of the study, critical revision of the manuscript. RA—critical revision of the manuscript. All the co-authors had access to the study data, they had reviewed and approved the final manuscript. All authors read and approved the final manuscript.

## Funding

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## Availability of data and materials

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

## Declarations

### Ethics approval and consent to participate

The study protocol was done in accordance with the ethical guidelines of the 1975 Helsinki Declaration. The ethical approval for both the scientific and the ethical aspects to conduct the study was obtained before initiation of the study from the committee of Ethics of Faculty of Pharmacy, Ain Shams University (serial number of protocol: Ph.D. No.54) and the research ethics committee for experimental and clinical studies at faculty of Pharmaceutical Sciences and Pharmaceutical Industries, Future University, Cairo, Egypt. The study was registered in ClinicalTrials.gov (NCT03698292).

### Consent for publication

The authors declare no conflict of interest.

### Competing interests

The authors declare that they have no competing interests.

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