Knowledge of Intensive Care Nurses Regarding the Monitoring of Early Enteral Nutrition

Nomaxabiso M. Mooi
https://orcid.org/0000-0002-2565-5981
University of KwaZulu-Natal, South Africa
mooi@ukzn.ac.za

Abstract

Early initiated and uninterrupted enteral nutrition is associated with the reduction of disease severity, diminished complications, decreased hospital length of stay, and favourably affects the outcomes of critically ill patients. The aim of the study was to assess the knowledge of early enteral nutrition (EEN) monitoring among intensive care unit (ICU) nurses in selected facilities in the Eastern Cape, South Africa. A quantitative, descriptive and cross-sectional design was followed. A total of 115 questionnaires were distributed and 70 were returned giving a response rate of 61 per cent. Data were analysed using the Statistical Package for Social Sciences, version 21. The results showed that younger and less experienced nurses in private hospitals were more knowledgeable about EEN than the nurses in public hospitals. Regarding tolerance and adequacy monitoring, 60 per cent of the respondents reported the availability of enteral nutrition protocols while 40 per cent of the respondents disagreed that the protocols were available, which clearly stated a lack of efficient monitoring practices. Further, the varied knowledge reported by ICU nurses could be related to unclear protocols regarding procedures to be followed in monitoring tolerance and complications of EEN in the ICUs. Nurses, as primary care providers, should be equipped with the necessary knowledge to be able to advocate for EEN and to monitor the tolerance and adequacy of nutrient delivery.

Keywords: enteral nutrition; early enteral nutrition; enteral nutrition tolerance monitoring; critically ill patient

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Introduction and Background

Current guidelines on nutrition recommend that enteral nutrition (EN) be initiated early and advanced towards target nutrition goals as quickly as tolerated over 24–48 hours while monitoring for complications such as the refeeding syndrome that may influence tolerance and early enteral nutrition (EEN) adequacy (McClave et al. 2016, 164; Stewart 2014). The main reasons for providing EEN include maintaining gut integrity, modulating stress and the systemic immune response, and reducing disease severity (McClave et al. 2016, 165). Sharada and Vadivelan (2014, 205) add that starting EN early helps to identify indications for and the use of prokinetic agents early as possible, and to improve gastric tolerance and thus adequacy of nutrient delivery. The refeeding syndrome is a consequence of reinitiation of feeding in a previously starved and malnourished patient (Preiser et al. 2015). Its complications include an imbalance of electrolytes, such as phosphate, potassium, magnesium and sodium, and fluid retention potentially leading to heart failure, respiratory failure, and death (Preiser et al. 2015). These may indicate malnutrition, increased complications, and a prolonged stay in the ICU (Preiser et al. 2015). Little is understood regarding the adoption and implementation of EN practice recommendations, as basic practices such as feeding tube verification remain varied with detrimental effects that include death of patients (Bourgault et al. 2014, 135).

Intensive care unit (ICU) nurses spend more time at the patients' bedside than other healthcare providers and are the ones to initiate and monitor for feeding intolerance, and advancement and discontinuation of EEN intolerance (Marshall et al. 2012, 187). EEN intolerance can be referring to volume or the formula used, but classic symptoms include the absence of or abnormal bowel sounds, vomiting, bowel dilatation, diarrhoea, gastrointestinal bleeding, and high gastric residual volumes (GRVs) (McClave et al. 2016, 164). If EN intolerance continues without any intervention, consequences can be inadequate nutrient delivery, delayed healing and infections that contribute to a prolonged ICU stay, increased mortality and morbidity and higher treatment costs (Shahin, Mohamed, and Sayed 2012, 397). Evidence-based protocols are recommended to guide nurses on the administration, monitoring and evaluation of EN adequacy in order to improve nutrient delivery in critically ill patients.

Continuous education on EN can play a part in the adherence to protocols thus, standardisation of clinical nutritional practice and knowledge improvement (Shahin, Mohamed, and Sayed 2012, 398). However, there are a number of reasons that hinder the effective use of these protocols for monitoring of EN and management of related complications among ICUs nurses. Some of the reasons include the lack of awareness of their availability, which leads to poor or non-adherence and thus delayed and poorly monitored EN (Marshall et al. 2012, 189). Research also shows that there is limited literature on nurses' knowledge regarding the time of initiation and monitoring of

nutritional therapy in critically ill patients. More research is therefore necessary to correct these deficits and successfully empower nurses to become nutritional champions at the bedside of patients (Marshall et al. 2012, 192). Using nurses as agents of change will help standardise EN practices and ensure that critically ill patients are optimally fed (Marshall et al. 2012, 192).

Statement of the Research Problem

EEN has recently been identified as a proactive strategy to reduce the metabolic response to stress, to prevent oxidative cellular injury, and to favourably modulate immune responses during critical illness (Taylor et al. 2014, 640). However, in many critical care settings, EN is found to be delayed and grossly interrupted owing to poor monitoring that is related to inadequate knowledge and lack of awareness of published recommendations for clinical practice (Hill 2015, 42). As such, patients receive about 50 per cent of the prescribed nutritional targets, 59 per cent of their energy needs and 60 per cent of their nutrition needs in the ICUs owing to inadequate knowledge and poor monitoring practices (Hill 2015, 50). Early and uninterrupted EN is known for its positive influence on gut barrier function and its significant effects on morbidity and mortality (Preiser et al. 2015).

Aim of the Study

This study aimed to assess the knowledge of EEN monitoring among ICU-registered nurses in selected facilities in East London, Eastern Cape, South Africa.

The Specific Objective of this Study

To describe the knowledge of EEN monitoring among ICU-registered nurses in public and private hospitals in East London.

Definitions of Key Concepts

Critically ill patient is a patient who is acutely ill with two or more organs failing and at risk of developing malnutrition due to the inflammatory response, metabolic stress and bed rest, which cause catabolism. In this study, these are the patients admitted in the selected ICUs and nursed by the nurses under study.

Early enteral nutrition means enteral nutrition initiated within early feeding that is within 24 hours of admission as soon as the patient is resuscitated and haemodynamically stable.

Enteral nutrition refers to feeding via a tube placed in the gut to deliver liquid formulas containing all essential nutrients with benefits that include the reduction of infectious morbidity, hospital stay and hospitalisation costs.

Enteral nutrition monitoring involves observing the time of initiation, gastric tube position checks, GRV measurement, and surveillance for signs of intolerance through use of chest and abdominal X-rays, intake and output records. Blood tests for glucose, urea and electrolytes are also used for this purpose to ensure adequacy of nutrition.

Enteral nutrition intolerance can be defined by vomiting, abdominal distension, complaints of discomfort, high nasogastric (NG) output, high GRVs, diarrhoea, reduced passage of flatus and stool, or abnormal abdominal radiographs.

Enteral nutrition tolerance is passage of flatus and stool, normal abdominal radiograph, and absence of complaints of pain or abdominal distension.

ICU nurses are nurses registered with the South African Nursing Council who are the primary care providers responsible for administration and monitoring of nutritional support in critically ill patients admitted in the ICU.

Research Methodology

Research Design

A quantitative, descriptive and cross-sectional design was employed using self-administered questionnaires on registered nurses (RNs) working in selected ICUs. This positivist design emphasises measurement of the objective reality using numbers and statistical analysis (Creswell 2013, 36). A quantitative study facilitated better assessment of the knowledge of ICU nurses regarding EEN initiation time and monitoring of tolerance and adequacy in critically ill patients, and the relationship between the knowledge and demographic variables. Further, the descriptive design enabled the ICU nurses to be studied in their place of work about what happens in the ICU on a daily basis. This is supported by Harerimana and De Beer (2013, 31) when they state that descriptive studies observe conditions in their natural setting.

Study Setting

The study took place in ten ICUs of two public and three private hospitals in the East London urban area in the Eastern Cape, South Africa. The public hospitals are referral hospitals and the biggest in the province, while one private hospital is a regional hospital receiving patients from nine private hospitals and eight private clinics in the province. The public hospitals receive referrals from 5 districts, 76 hospitals and 56 clinics in the Eastern Cape. The setting was selected because it seemed to have potential to represent South African hospitals. According to Mgudlwa et al. (2017, 160), quantitative studies conduct statistical data analyses and use the data to generalise comparisons to the broader population.

Target Population

This study targeted the RNs working in the selected two public and three private hospitals in East London from mid-September to end October 2013.

Sampling

Purposive sampling was used to select the hospitals and convenience sampling was employed to sample the ICUs and RNs in these hospitals. The number of RNs accessed and conveniently sampled from each unit is shown in Table 1.

Table 1: Distribution of ICU nurses in each hospital

Selected hospitals and ICUs	*Accessible population (N = 115)*	*Study sample (n = 70)*
Public Hospital 1 Adult ICU Paediatric ICU	 N = 34 (29.5%) N = 16 (13.9%)	 n = 31 (44.3%) n = 11 (15.71%)
Public Hospital 2 Adult ICU Paediatric ICU	 N = 6 (5.2%) N = 4 (3.47%)	 n = 2 (3.0%) n = 1 (1.5%)
Private Hospital 1 Surgical ICU Medical ICU Cardiac ICU	 N = 15 (13.04%) N = 10 (8.7%) N = 10 (8.7%)	 n = 8 (11.43%) n = 5 (7.14%) n = 4 (5.71%)
Private Hospital 2 General ICU	 N = 5 (4.4%)	 n = 1 (1.5%)
Private Hospital 3 Adult ICU Paediatric ICU	 N = 5 (4.4%) N = 10 (8.7%)	 n = 3 (4.3%) n = 4(5.71%)
Total	N= 115(100%)	n = 70 (61%)

Eligibility Criteria

RNs were included if they were registered with the South African Nursing Council and have worked in the ICU for at least six months, with or without an ICU qualification. All the RNs not working in the ICU, absent during data collection and those who refused to participate in the study were excluded.

Data Collection Instrument

A self-administered questionnaire developed by the researcher, based on an in-depth literature review, was used to collect data. The questions on demographic characteristics included age, hospital type (public or private), experience in nursing and experience in

ICU nursing. The knowledge regarding EEN initiation time tolerance and adequacy was covered by 11 questions that warranted the respondents to agree or disagree.

Content and face validity was checked by two experts (a dietician and an ICU trained nursing manager with more than 25 years' experience) and minor editing errors were corrected. In assessing the instrument's reliability, the questionnaire was pretested on eight RNs; four working in the adult high care unit and four working in a neonatal high care unit in one public hospital, and yielded a Cronbach's alpha coefficient value of 0.7. The pretest also helped to assess clarity and the time needed to complete the questionnaire. Minor editing errors were corrected to the tool and results from the pilot study were not included for analysis.

Data Collection

After obtaining ethical clearance from the University of Fort Hare and permission from the gatekeepers, namely the Eastern Cape Department of Health Research Directorate, the Life Healthcare Group and authorities of the respective hospitals, data collection started from mid-September to end October 2013. Appointments were made to meet the respondents through the hospital managers. Respondents were approached face-to-face to invite them to participate in the study, a full explanation of the study including the objectives was given, and those who were willing to participate gave written consent. The researcher began distributing the questionnaires immediately and because of the unpredictable routine in the ICU, would leave the questionnaires that were not completed in a sealed envelope, separate from the consent forms, with the unit manager. The questionnaires were completed during on-duty time; completion of a questionnaire took approximately 10–15 minutes.

Data Analysis

The Statistical Package for Social Sciences (SPSS), version 21, was used to analyse the data. Descriptive statistics were used to analyse the data on the nurses' EEN knowledge and monitoring for tolerance and adequacy; data are presented as means, frequencies and percentages. Confirmatory analysis results for statistical significance were presented and interpreted, which included testing whether there was a correlation between age, nursing experience and ICU experience and knowledge variables within public and state hospitals. The t-test of the two independent samples was also used to check the relationship between ICU training and knowledge on the timing and monitoring of EEN.

Ethical Considerations

Ethical clearance (Certificate Reference Number: MBA01 1SMOI01) and permission to conduct the study were sought from the University of Fort Hare, the provincial Department of Health Research Directorate, and a private healthcare company.

Informed consent was obtained from the respondents before data collection started. Codes were used to maintain anonymity and respondents were discouraged to discuss their responses to enhance confidentiality. The data could not be traced back to the respondents and they were informed that they could withdraw from the study at any time.

Results

Of the 115 RNs that were accessed, 70 returned the completed questionnaires, yielding a 61 per cent response rate.

Characteristics of the Respondents

A total of 36 per cent (n = 25) of the respondents were from private hospitals, while 64 per cent (n = 45) were public nurses. Their ages ranged from 25 years to 65 years. The characteristics of the respondents are presented as averages in Table 2.

Table 2: Characteristics of the respondents

Variables	*Public* *N = 45 (64%)*	*Private* *N = 25 (36%)*
Age, average	46	43
Experience in ICU, average (years)	10	11
Experience in nursing, average (years)	20	18
Knowledge of EEN initiation time	40.4%	49.6%

Enteral Nutrition Tolerance

The respondents varied on several aspects of EN monitoring, namely the availability of standard monitoring protocols, blood glucose levels being an indicator of carbohydrate intolerance, usefulness of bloods for urea, and electrolytes in determining EN adequacy. In addition, 57 per cent of 70 nurses believed that intake and output records might be useful in assessing EN adequacy. The ICU nurses' responses on monitoring of tolerance and adequacy of EN are shown in Table 3.

Table 3: Knowledge of EN tolerance monitoring

Statement	*Yes*		*No*	
	Freq.	*%*	*Freq.*	*%*
There is a standard protocol to monitor the tolerance to nutritional support	42	60	28	40
The procedure to be followed regarding the monitoring of nutrition tolerance is stated clearly in the protocol	38	54	32	46
The protocol does not state the management of intolerances in the unit	31	44	39	56
Chest and abdominal X-rays have little or no value in monitoring EN	42	60	28	40
The normal GRV is 200–500 millilitres	32	46	38	54
The guidelines state that two four-hourly gastric aspirations are practiced only in the initial hours of enteral feeding to monitor tolerance	22	31	48	69
Tolerance to the volume is checked by aspiration of gastric contents only when large volumes are administered	20	29	50	71
Blood glucose levels are an indicator of a patient's carbohydrate intolerance	47	67	23	33
Bloods for urea, creatinine and electrolytes assist in determining the adequacy of nutritional support	52	74	18	26
Intake and output records are indicators of the adequacy of nutrient delivery	30	43	40	57
Physical examination cannot assist in assessing the adequacy of nutritional support especially in critically ill patients	22	31	48	69

Correlation Analysis of Demographic Characteristics of Respondents and Knowledge of EEN

For the question on the ideal time for initiating EEN, respondents were required to choose between 24, 48 and 72 hours following admission to ICU based on the published EN practice guidelines that were current at the time of data collection. The Pearson correlation results showed that the knowledge about EEN initiation time was negatively associated with age ($r = -0.53$, $p = 0.0033$), nursing experience ($r = -0.69$, $p = 0.0023$), and ICU experience ($r = -0.60$, $p = 0.0096$) among the private hospital nurses. This means that the older and more experienced nurses are associated with lower knowledge. In the public hospitals, the nurses' knowledge about EEN initiation time was found to be positively associated with age ($r = 0.38$, $p = 0.041$) and nursing experience ($r = 0.38$, $p = 0.038$). This means that the older and more experienced the nurses, the higher their knowledge score.

The Relationship between ICU Qualification and Knowledge of EEN Initiation Time

The RNs' knowledge of the time of initiating EEN and information regarding ICU qualification of the nurses were also measured as shown in Table 4.

Table 4: ICU qualification and knowledge of EEN initiation time

Variable	*ICU qualified*	*Non-ICU qualified*
ICU qualified	53% (n = 37)	47% (n = 33)
EEN initiation time knowledge score	40.9% (n = 28)	59.1% (n = 42)

A t-test of two independent samples was then used to test for the relationship between ICU qualification and knowledge variable. It was found that knowledge regarding the initiation time of EEN was significantly higher for the non-ICU care trained ($t = 2.92$, $p = 0.008$).

Discussion

The current study results show that young and less experienced registered ICU nurses in private hospitals had more knowledge on EEN initiation time than older nurses did. These results may be explained by another study that was conducted at the Nelson Mandela University in South Africa, which found that younger nurses seemed to be familiar with the concepts of evidence-based practice (EBP) (Jordan, Bowers, and Morton 2016, 50). According to these authors, this is probably owing to their better technological orientation and therefore easier access to current EBP literature (Jordan, Bowers, and Morton 2016, 50). Younger nurses are seen to be more cooperative and more receptive to learning new ideas with better tolerance and memory abilities (Shahin, Mohamed, and Sayed 2012, 403). Further, the knowledge difference between public and private nurses could be owing to the fact that the private sector is profit-oriented and therefore puts more effort in to capacitate their staff and applies more stringent measures to enforce competency. This study also showed a higher score of knowledge in non-ICU trained nurses compared to ICU-trained nurses, which is inconsistent with the results of a study by Shahin, Mohamed and Sayed (2012, 404) that reported improvement in the nurses' knowledge regarding EN after an instructional programme.

Another important result was that 60 per cent of the respondents attested to the availability of EN protocols in the units. However, the protocols were also seen as not stating the management of EN intolerance and complications by 44 per cent of the respondents. Protocols that are not clear in guiding EN monitoring may result in varied monitoring practice that is based on personal opinion and thus in inadequacy in nutrient delivery, increased morbidity, a prolonged stay in ICU and an increased mortality rate

(McClave et al. 2016, 164). Protocols in the ICU setting are designed to promote compliance with clinical practice guidelines and directed nutrition practices, to promote consistent approaches and to ensure the adequate delivery of nutritional therapy (Compton et al. 2014, 397; Marshall et al. 2012, 192; Taylor et al. 2014, 639).

Another area of concern is that 46 per cent of the respondents stated that a GRV of 200–500 millilitres is normal, when according to McClave et al. (2016, 163) that amount should raise concern as it increases the risk of aspiration and ventilator-associated pneumonia. The authors argue that high GRVs of 150 to 500 millilitres of an aspirate may indicate EN intolerance, however, a single elevated GRV requires no action, only ongoing monitoring (Marshall et al. 2012, 190; McClave et al. 2016, 163). According to Marshall et al. (2012, 190) GRVs may not be a useful tool to assess the risk of aspiration pneumonia. Further, there is even a suggestion that GRVs should be removed from the standard care of critically ill patients, especially those receiving EEN, as GRVs do not correlate with incidences of pneumonia (McClave et al. 2016, 163; Reignier et al. 2013, 255). It has been shown that eliminating the practice of using GRVs improves nutrient delivery without risking patient safety (McClave et al. 2016, 170). Consistent with the results of a study by Hill (2015, 42), 71 per cent of the respondents of the current study seemed not aware of published guideline recommendations based on the contrasting responses to questions on guideline recommendations. According to the author, this can be an indication that the implementation of published nutrition guidelines is not well established in the settings (Hill 2015, 50).

A total of 69 per cent of the respondents of the current study indicated that physical examination could assist in assessing adequacy of EN, which is consistent with current nutrition therapy recommendations. Current guidelines suggest that tolerance may be determined by physical examination, passage of flatus and stool, radiologic results, and absence of patient complaints such as pain or abdominal distension (McClave et al. 2016, 170). Abnormal abdominal X-rays can be a sign of feed intolerance, while chest X-rays might assist in the confirmation of nasogastric (NG) position and the diagnosis of silent aspiration, a consequence of EN intolerance (McClave et al. 2016, 170). In the current study, 60 per cent of the respondents indicated that chest and abdominal X-rays having little or no value in monitoring adequacy of nutrient delivery, which is inconsistent with published guidelines.

Results of the current study revealed that 67 per cent of the respondents indicated that glucose levels are an indicator for carbohydrate intolerance, which is encouraging. Literature asserts that the catabolic stress response to critical illness leads to insulin resistance and hyperglycaemia, which causes delayed gastric emptying (Mabrey et al. 2015; McClave et al. 2016, 163). This can suggest that hyperglycaemia in enterally fed critically ill patients is associated with carbohydrate intolerance (Wright-Myrie, Kahwa, and Dover-Roberts 2013, 49).

Of the respondents, 75 per cent indicated that bloods for urea, creatinine and electrolytes are effective in determining EN adequacy. Low serum albumin, creatinine and electrolyte imbalance is associated with muscle wasting and the body's response to starvation from delayed EN and regarded as a sign of inadequate nutrient delivery (Sharada and Vadivelan 2014, 206; Stewart 2014, 15). However, care should be taken when making decisions based on these findings, as traditional serum protein markers can also reflect acute-phase response to critical illness than nutrition status (McClave et al. 2016, 163). What is important is that patients at potential risk of malnutrition should be fed slowly, and electrolyte and other micronutrient levels should be closely monitored and supplemented accordingly (Preiser 2015, 4). Again, electrolyte abnormalities can indicate the refeeding syndrome and may include hypophosphatemia, hypokalemia, and hypomagnesemia along with sodium and fluid retention (Preiser et al. 2015).

The respondents differed on the intake and output records as indicators of adequacy of EN delivery when these records are seen as important and reliable tools for nutritional diagnosis. Through intake and output records, ICU nurses can detect nutrient deprivation timeously and facilitate prompt treatment of such deficits. Nutrition target goals and administered amounts are recorded in the intake and output records and many EN-related complications that indicate inadequate feed delivery are normally also documented on the intake and output records.

Conclusions

The results show that younger and less experienced nurses in private hospitals and older and experienced nurses in public hospitals have more knowledge of EEN than their counterparts do. The varied responses of RNs regarding monitoring procedures and management of feed intolerance can mean that the available protocols are not clear in all the ICUs. Unclear protocols can make it difficult to standardise and improve the EN monitoring practice in the ICUs. Furthermore, based on the knowledge variables reported in this study, regardless of ICU training, age and experience, there is a need for well-developed and valid protocols regarding EN to direct practice and to improve knowledge in the clinical setting.

Recommendations

This study therefore recommends continuous nutrition education to keep nurses working in ICUs updated on nutrition practices, especially monitoring and managing EN intolerance, regardless of their ICU qualification. This can also redress the issue of the ICU trained nurses showing lower knowledge on a very important variable of the EEN initiation time than the non-trained ICU nurses. Based on the varied responses regarding standard protocols, it is recommended that ICU nurses lead the development of standard protocols based on published guidelines recommendations and adapt these

to the local context to improve acceptance and adherence. Collaborative nutrition training sessions between public and private ICU nurses are recommended to redress the knowledge level differences. The bottom-up or nurse-led protocols may allow nurses to own and internalise guides developed by them rather than top-down ones that are imposed on them, which may cause confusion.

Limitations of the Study

The results of this study cannot be extrapolated to all ICU nurses in the Eastern Cape, as the sample only comprised 70 nurses and the study was conducted in only a few hospitals that are in the same town. A larger sample size is needed for adequate power to corroborate these results. Future research methods could consider direct observation of EN practices and interviews to explore possible reasons for poor adoption and implementation of clinical practice recommendations rather than using predetermined questions that are based on assumption. No proper conclusions can be drawn from this study results as not all knowledge variables about EEN were dealt with and correlations not tested to all those reported. Lastly, the respondents might have been under pressure when completing the questionnaires, as this was done during duty time.

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