ORIGINAL RESEARCH

Effect of an educational intervention on nursing knowledge about enteral nutrition therapy: A quasi-experimental study

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ABSTRACT

Background and objective: Permanent education is an important strategy to improve nurses' knowledge and professional practice. This study assessed the improvement on the knowledge of nurses after attending an educational intervention on enteral nutritional therapy using clinical simulation.

Methods: A quasi-experimental study was conducted with 41 nurses with pre-and post-testing. Two clinical simulation scenarios were applied using the National League for Nursing Jeffries Simulation framework: the first was about the indications for enteral nutritional and insertion of the feeding tube, and the second was about enteral feeding monitoring and control of complications. The intervention was developed according to the guideline for reporting evidence based practice educational interventions and teaching. A validated instrument was used to verify knowledge of enteral nutritional therapy. There was a high level of inter-rater agreement.

Results: The analysis of the clinical simulation showed a statistically significant difference between the pre- and post-training scores in all domains of the instrument ($p < .05$). The effect size was large (Cohen's d = 0.946). The educational intervention with two clinical simulation scenarios significantly improved nurses' knowledge of enteral nutritional therapy.

Discussion and conclusions: In general, this research provided nurses with improved knowledge regarding the care of patients using enteral nutrition therapy, contributing to the innovation of care with practices based on scientific evidence. Pre-and post-test analyzes showed that nurses had better knowledge scores on enteral nutritional therapy after the educational intervention using clinical simulation. *Implications for clinical nursing practice:* Educational interventions based on clinical simulation promote clinical reasoning and decision-making within different levels of nursing praxis.

Key Words: Educational intervention, Nursing, Nutrition, Simulation

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1. INTRODUCTION

Nutrition has clinical importance for patient recovery and nursing practice.[1] In this sense, enteral nutrition therapy (ENT) is essential to prevent or treat malnutrition, reduce infectious complications, improve healing and hospitalization time, and decrease hospital expenses and mortality. Indications for this therapy should observe well-defined criteria, which include a detailed patient profile, risk of malnutrition, and the diagnosis of a fully or partially dysfunctional gastrointestinal tract, considering that one of the enteral nutrition access routes is through a nasogastric tube.[2,3]

As nurses perform many activities of nutritional assistance to patients, opportunities for permanent health education should provide constant training of nursing staff to reduce malnutrition rates and other complications related to the ineffective use of enteral nutrition.[4,5]

Given the above, educational actions in health, when inserted into the work environment, improve nurses' skills and performance for better care provision, encourage the creation of health policies, and strengthen the health system.[6,7] For this reason, at any level of management, proposals of practice transformation should be offered based on critical reflections and training aiming at improving work and problem-solving processes.[8]

Considering the context in which nurses work, nurses can use all pedagogical and communication strategies available to promote continuing education.[7] Therefore, there is a need for continuous professional training and educational opportunities to improve adherence to institutional protocols that improve the clinical outcomes of patients,[4] as well as evidence-based recommendations.

Educational interventions based on clinical simulation have emerged as efficient strategies for health professionals, including nurses who must perform highly complex procedures with technical competence.[9] The simulated clinical experience can offer greater support to the learners by directing activities to specific learning aims and performance needs,[10] and creating alternative situations and environments for developing technical and non-technical skills.[11]

Clinical simulation promotes cognitive, procedural, communication, and teamwork abilities.[12] It also supports the deliberate practice of clinical skills and behaviors before, during, and after exposure to simulation. Students or professionals can integrate theory and practice when undergoing clinical simulation as a pedagogical method based on current learning theories.[11] Concerning advanced nursing practice, an integrative review study showed that clinical simulation contributes to knowledge expansion, development of cognitive, procedural, and clinical judgment skills, and enhancement of leadership, teamwork, and communication skills.[13] Given the above, this study aimed to assess the improvement on the knowledge of nurses after attending an educational intervention on enteral nutritional therapy using clinical simulation.

2. METHOD

2.1 Study design

This is a quasi-experimental single-arm quantitative study with pre-and post-testing, carried out in a public hospital in Minas Gerais, Brazil, from September 2018 to March 2019. The study was registered on the Brazilian Clinical Trials platform (ReBEC), available at `http://www.ensaiosclinicos.gov.br`, under number RBR-4syyz2. The Consolidated Standards of Reporting Trials (Consort) was considered for the study design.[14]

2.2 Sample size calculation

The sample size was obtained using the software G*Power 3.1.9.2, based on the calculation for finite populations and intervention studies with a single group. A sampling error of 5% and a confidence interval of 95% were adopted, resulting in a minimum sample of 34 subjects. Forty-one subjects were recruited, considering a loss rate of 20%.

2.3 Study participants and sampling

Nurses working in emergency, general, and surgical wards and in intensive care units participated in the study. The participants were recruited by consecutive convenience sampling.

The study included nurses who provided direct care to adult patients receiving enteral nutrition therapy. Nurses recently hired or away from work during the data collection period were excluded. Nurses who were absent from any of the study stages were discontinued.

2.4 Ethical aspects

This study was approved by the Research Ethics and followed all Brazilian and international standards for research involving human beings.[15] All participants in the study provided written consent.

2.5 Data collection instruments

2.5.1 *Sociodemographic characterization*

The participants filled out a sociodemographic profile form comprising variables such as age, sex, level of education, time of program completion, type of hospital unit, time of professional experience, and previous training.

2.5.2 *Educational background*

The participants' educational background was assessed through a form about prior training and previous learning experiences about the importance of enteral nutrition in nurses' clinical practice.

2.5.3 *Professional practice*

The professional practice was assessed through a form containing the following variables: time working in healthcare institutions, clinical experience involving ENT, previous training and updating about ENT, knowledge of institutional protocols, the existence of a multidisciplinary team in the workplace providing support about ENT, information about the patient's underlying conditions that required ENT, and knowledge of the most used enteral nutrition routes.

2.5.4 *Nurses' knowledge of enteral nutrition therapy (NKENT)*

The NKENT instrument was used to assess the participants' knowledge of ENT in the pre- and post-test. This instrument has been created and validated by the principal investigator and published elsewere.[16] It has 38 categories distributed in 4 domains, evaluated using a 3-point Likert scale (right, not sure, or wrong): D1. Indication of enteral nutrition therapy; D2. Techniques of enteral feeding catheter insertion; D3. Monitoring of the enteral feeding; and D4. Control of complications.

The instruments were administered by trained research members. Between the pre-and post-test, the order of questions was changed.

2.6 Educational intervention program

The guidelines for reporting evidence based practice educational interventions and teaching (GREET), a checklist with explanations for the development of educational interventions, were followed.[17,18] The NLN Jeffries simulation theory[19] was used for the construction and implementation of the clinical simulation.

The material resources and equipment used for the development of the scenarios were provided by the hospital in which the study was undertaken. Given the number of phases involved in the clinical simulation and to avoid evaluation bias, the intervention team consisted of 17 researchers: the interventionist, three simulation specialists who worked with content validation (responsible for validating the scenarios and checklists used to evaluate the activities performed by participants), eight undergraduate nursing students who evaluated the activities conducted by the participants, four nursing students who applied the NKENT before and after the intervention, and a standardized patient.

Before the actual intervention, two scenarios were constructed to evaluate nurses' performance concerning enteral nutrition indications, catheter insertion, monitoring of feeding, and control of complications. Three nurses with theoretical and practical experience in clinical simulation validated the scenarios. The nurses evaluated the organization, scope, objectivity, and pertinence of each element of the scenario.[20]

After constructing and validating scenarios, a pilot study was carried out. The focus of this stage was to examine the acceptability and feasibility of the intervention. Acceptability refers to the participant's perception of the intervention in terms of its appropriateness, effectiveness, and convenience. Feasibility refers to the ease with which the intervention is provided and the factors that facilitate or hinder its implementation.[21] This stage involved the participation of five nursing residents who were not included in the main study.

Two fictitious clinical cases helped in the construction of the scenarios. The cases were about a fictitious patient who was evaluated at different times, allowing the nurses to develop their clinical reasoning, explicitly following the NKENT domains.

Case 1: 28-year-old female, admitted two days before, diagnosed with lung cancer. In the last month, she has had daily vomiting with undigested food about 1 hour after meals. She reports significant weight loss (20% of usual weight) and denies other illnesses. At the physical examination, she was fragile and unable to eat for more than eight days, even with diet changes. Then, the multidisciplinary enteral nutrition therapy team suggested enteral catheter feeding.

Case 2: 28-year-old female, hospitalized for 15 days and diagnosed with lung cancer. In the last month, she has had daily vomiting with undigested food about 1 hour after meals. She reports significant weight loss (20% of her usual weight). On the first day of hospitalization, a nutritional assessment was performed. The nurse inserted the feeding catheter to keep the patient's weight and nutritional status. She administered a polymeric formula of 1.5 Kcal per mL, through an infusion pump, at 110 mL per hour for 12 hours a day, totaling 1980 Kcal per day, to improve the patient's nutritional status during hospitalization. The patient also received water intake through a 250 mL catheter twice daily. At the physical examination, she presented stage I skin injury in the sacral region, with swollen and painful abdomen; she had 2 episodes of diarrhea with average quantity and 1 episode of vomiting during the day.

The intervention was performed during the participants working hours and was based on four stages, as recommended by Jeffries: 19 pre-briefing, briefing, clinical experience, and

debriefing (see Figure 1).

In the pre-briefing stage, the nurses were introduced to the simulated clinical experience, manipulated the instruments available, and asked questions. In addition, they were informed about the confidential character of the content of the scenarios and of information discussed in the training.

In the briefing stage, the main investigator provided the following information: 1) 28-year-old female, hospitalized for two days with a significant weight loss. 2) 28-year-old female, hospitalized for 15 days, receiving enteral catheter nutrition, presenting diarrhea, vomiting, and abdominal pain. This information was provided to the whole group, but they could not discuss it in the initial approach.

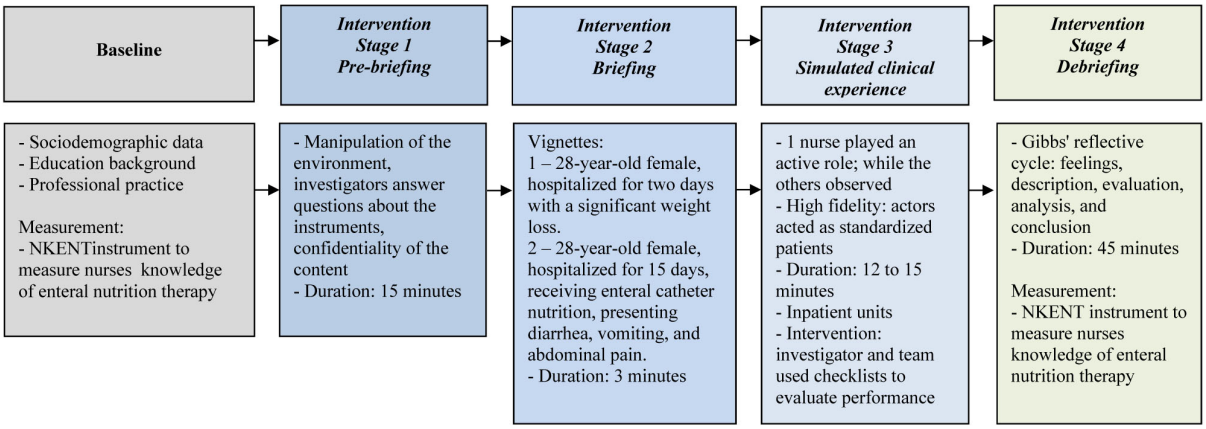

Figure 1. Data collection protocol
Note. NKENT = Nurses' knowledge of enteral nutrition therapy

In the briefing stage, the main investigator provided the following information: 1 – 28-year-old female, hospitalized for two days with a significant weight loss. 2 – 28-year-old female, hospitalized for 15 days, receiving enteral catheter nutrition, presenting diarrhea, vomiting, and abdominal pain. This information was provided to the whole group, but they could not discuss it in the initial approach.

One nurse acted in the simulated clinical experience while the others observed the scenarios, with no assessment of the activities performed. The intervention with high-fidelity scenarios had a duration of 12 to 15 minutes, simulating inpatient units. Nursing students trained by the main investigator played the role of standardized patients, with speeches from a script. During their performance, the intervention investigator and eight trained nursing students used a checklist to assess those who acted in the scenarios generating content for the debriefing stage. The construction of this material was based on the NKENT domains and was submitted to content validation by the same experts who evaluated the scenarios.

Finally, the main investigator conducted the debriefing stage with the collaboration of the support team. At this moment, nurses' performance considered Gibbs's reflective cycle model,[22] which comprises the stages of description, feeling, evaluation, analysis, conclusion, and action plan. This stage lasted around 45 minutes.

2.7 Statistical analysis

Data were categorized in Microsoft Excel® spreadsheets and analyzed using SAS software, version 9.4. The absolute and relative frequencies of categorical variables and the measures of position and dispersion of continuous variables were calculated. In addition, the Shapiro-Wilk test evaluated data distribution.

The percentage agreement test assessed the inter-rater agreement among the observations of those who administered the checklists to evaluate nurses' performance. The acceptance criterion was an agreement value equal to or greater than 0.90.[23] In addition, the frequency of correct answers for each item was analyzed.

The analysis of answers obtained through the NKENT instrument considered two categories: 1 – Right, and 2 – not sure/wrong, considering that only answer 1 was correct. The paired Student's t-test or the paired Wilcoxon test was used to compare pre- and post-training scores obtained through the NKENT instrument. The McNemar test was employed for comparisons between items. Effect size measurements were calculated as part of unpaired Student's t-test and an Anova analyses.[24] Multiple linear regression models were also developed via generalized linear models,[25] using dependent variable scores. Finally, the effect of the intervention was assessed using Cohen's d, which estimates the effect size.[24] The significance level adopted was 5%.

3. Results

3.1 Pilot study

Some aspects of the simulation were adjusted based on suggestions from the participants, including the content of the clinical cases for better understanding, the script with actions to be executed in simulation scenarios 1 and 2 (to improve the reactions and speeches of the actors), and the organization of the scenarios for a better flow of activities.

When performing scenarios 1 and 2, the evaluators agreed on all checklist items. Relevant activities such as physical clinical tools, social interactions, and structured interventions were included. All participants took part in a combination of these activities, regardless of role assignments or goals.

3.2 Educational intervention program

Five groups of clinical nurses participated in the intervention (G1, 8 nurses, G2, 9 nurses, G3, 8 nurses, G4, 8 nurses, and G5, 8 nurses) distributed in the different hospital care units. These nurses participated in the stages of pre-briefing, briefing, clinical experience, and debriefing.

3.3 Sample characterization

Seventy-six percent of the participants were female, with a mean age of 50 years; 73% had a nursing degree from a private institution, 93% were specialists from different nursing areas, and 7% had a master's degree. The mean of years working in the unit was 12 years, 48% had a working experience of 5 to 10 years, and 52% of 10 to 20 years. Fifty-one percent of the participants worked in medical and surgical wards, 27% in intensive care units, and 22% in the emergency room.

Concerning the clinical practice involving ENT, all nurses considered that knowledge of the content is important; 98% said that they were aware of the new enteral nutrition protocols, and 88% described performing activities involving ENT. Concerning the enteral nutrition training, 5% rated the training as excellent, 71% as good, 20% as fair, 2% as bad, and 2% did not answer the question. Regarding updates on ENT, 78% said they had improved, and 71% reported having participated in prior training on the subject. In comparison, 42% sought information from scientific articles, 25% on websites, 20% from other professionals in the area, and 13% from congresses, symposiums, lectures, or books.

3.4 Effect of the intervention program

The checklist used in the assessment of the "Indication of enteral nutrition therapy and feeding catheter insertion technique" scenario consisted of 29 actions, and the number of correct answers ranged from 14 to 21. The "Monitoring of enteral feeding and control of complications" scenario comprised 14 actions, and the number of correct answers ranged from 4 to 12.

During the debriefing, the participants reported that the educational intervention was positive and contributed for learning. Those who watched the performances of others in the scenarios reported that the experience made them review their own clinical reasoning. When asked about what could they do differently, the answers referred to four aspects: feeding indications, catheter insertion, monitoring, and catheter obstruction prevention. Moreover, they reported that the educational intervention made them learn what to do to handle diarrhea, nausea, and vomiting. The analysis of the NKENT scores at the pre- and post-test revealed a statistically significant knowledge improvement in all domains (see Table 1). The post-intervention score was higher in all domains, and the final scores improved from 2.1 (Domain 3) to 3.7 (Domain 1). Considering the total NKENT score, the difference between the pre- and post-test assessments was 11.9. A large effect size was found for all domains and the instrument's total score based on Cohen's d effect size.

Table 1. Comparison of scores obtained from the NKENT instrument with the experimental group in pre-and post-testing of the educational intervention using clinical simulation

Variables	Period	Mean (SD)	Median	Range	*p*-value	Effect size (Cohen's d)
Domain 1-Indication of enteral nutrition therapy (1-10)	Pre	5.8 (1.9)	6.00	2.0-10.0	< .001*	0.892
	Post	9.5 (0.7)	10.00	8.0-10.0		
Domain 2-Insertion of a feeding catheter (1-9)	Pre	5.4 (1.3)	5.00	2.0-8.0	< .001†	0.932
	Post	8.6 (0.7)	9.00	7.0-9.0		
Domain 3-Monitoring of the enteral feeding (1-10)	Pre	7.3 (1.7)	7.00	1.0-10.0	< .001†	0.803
	Post	9.4 (0.8)	10.00	7.0-10.0		
Domain 4-Control of complications (1-9)	Pre	5.5 (1.6)	5.00	2.0-9.0	< .001†	0.896
	Post	8.6 (0.7)	9.00	7.0-9.0		
NKENT total score (1-38)	Pre	24.1 (4.8)	24.00	10.0-35.0	< .001*	0.946
	Post	36.0 (1.3)	36.00	32.0-38.0		

Note. NKENT = Nurses' knowledge of enteral nutrition therapy; *Student *t*-test; †Wilcoxon test.

The McNemar test also revealed statistically significant differences. At the post-training, the number of right answers improved in all domains ($p < .001$). However, no associations were found between the outcome and sex, time of professional experience, or type of hospital unit. When analyzing the influence of age, sex, time of professional experience, and type of hospital unit, the only significant predictor of enhanced performance was time of professional experience (those with more than ten years had a better performance in Domain 2 after the intervention, see Table 2).

Table 2. Multiple linear regression models considering the scores obtained from the NKENT instrument after clinical simulation

Independent Variables	Score D1		Score D2		Score D3		Score D4		Score Total	
	β	95% CI*	β	95% CI*	β	95% CI*	B	95% CI*	β	95% CI*
Age	0.00	-0.01-0.01	-0.01	-0.01-0.00	-0.01	-0.01-0.00	0.00	-0.01-0.01	0.00	-0.01-0.00
Sex (Male)	0.03	-0.01-0.08	-0.02	-0.07-0.03	-0.04	-0.09-0.02	0.01	-0.05-0.06	0.00	-0.03-0.02
Time of professional experience (> 10)	-0.03	-0.08-0.03	0.09†	0.04-0.14	0.05	-0.01-0.11	-0.04	-0.10-0.02	0.02	-0.01-0.05
Work unit (emergency)	0.03	-0.03-0.08	-0.01	-0.06-0.05	-0.03	-0.10-0.03	-0.01	-0.07-0.05	-0.01	-0.03-0.02
Work unit (ICU)	0.01	-0.05-0.06	-0.05	-0.10-0.01	0.02	-0.04-0.08	-0.04	-0.10-0.02	-0.02	-0.04-0.01

Note. NKENT = Nurses' knowledge of enteral nutrition therapy; *95% confidence interval; †*p*-value< .05.

4. DISCUSSION

This study showed that clinical simulation contributed to the improvement of nurses' knowledge of ENT. Simultaneously, a description was provided, showing how the educational intervention was structured to enable learning and be a meaningful experience for nurses. The three-person assessment of the participants' performance allowed the identification of confounding factors, which were addressed during the debriefing.

It is essential to highlight that lack of knowledge, lack of observance of nutritional guidelines, and inconsistencies in professional practice contribute to malnutrition in patients.[26] As in this study, a prior analysis presented limited content about ENT in nursing education or clinical environment,4 which may affect nurses' knowledge, patient safety, and clinical outcomes. In this case, clinical simulation activities have been recommended in university teaching and professional practice environments to reduce the gap between theory and practice and improve nurses' confidence and clinical reasoning skills. The expected results include nurses with better knowledge, self-confidence, and autonomy.[27–29]

An increase in the post-test scores was observed indicating a positive effect of the teaching-learning process and a successful experience. However, continuing education is needed with greater continuity and permanence until the retention and transfer of knowledge to professional practice are longer.[30] It cannot be guaranteed that, after some time, the effect of the simulation on nurses' knowledge and skills will remain positive without continuous interventions and innovations.[30]

In this study, it was impossible to compare knowledge between nurses who played a role in the scenarios and those who just observed. However, a prior study with nursing students showed that those who observe scenarios were as good as or better than those who played interactive roles.[31] The low level of stress in all simulation stages and the possibility of a more comprehensive and detailed scenario allow observers to develop their clinical reasoning, even without clinical decision-making.

When observing those who played a role in the scenarios, despite their greater stress, the distribution of roles influenced their activities, the complexity of their involvement with standardized patients and other participants, and the meaning attributed to the experience. Then, as seen in this study, the opportunity to repeat activities of different goals and levels of complexity favors the development of skills and learning.[31]

Researchers have shown that theoretical knowledge can be acquired and maintained through clinical simulation, observation, debriefing, and learning in a simulated environment, and clinical skills can be learned and practiced.[32,33] This learning process is consolidated in debriefing when the participant reflects on the practical activities performed.[33–35] A recent study showed that regular simulation effectively increased knowledge and technical and non-technical skills in trauma care among ambulance nurses, making them readily available in memory and quickly retrieved in trauma situations.[33]

Despite not being the objective of this study, the participants reported that the intervention was effective and significant and promoted clinical reasoning and pragmatic attitudes toward patients receiving ENT. This is significant for nurses, as clinical experience simulation can better support clinical learning by creating alternative situations and environments

to skill development.[11] Similar findings were found in a previous study with resident nurses whose debriefing moments were highly significant. They favored the development of clinical reasoning and judgment through reflections and review of clinical aspects and factors such as skill development and confidence.[36]

Patients receiving enteral therapy must be given a care plan with educational activities that must be performed by the nurses and themselves early or as soon as gastric or enteral feeding starts. Continuing education provide consistent instructions, put nursing guidelines into practice, improve the quality of care, and reduce costs related to complications.[37]

Continuing education is essential for health professionals who care for patients requiring specialized nutrition.[38] Nurses play an essential role in implementing care plans for critically ill patients,[19] as they request the start of enteral nutrition, evaluate caloric needs, start, monitor, and administer enteral feeding,[39,40] among other activities.

Health care is constantly changing in every way, including enteral nutrition, making professionals update relevant aspects. However, in this study, nurses underused scientific knowledge, searching for different sources, mainly contacting other nurses, as reported in a previous study.[41]

In this context, the results of educational interventions using clinical simulation can improve the quality of healthcare by enhancing skills, such as those involved in patient safety.[42] In this sense, the literature has reported the concept of translational simulation, in which the use of this intervention aims to develop individual and group knowledge and abilities and solve complex issues with positive outcomes to the service.[12]

The new terminology uses simulation as a service, besides diagnosis and intervention. In this study, the acquisition of knowledge about ENT through simulation was an effective strategy to implement specific processes and procedures. Moreover, it is recommended that the scenarios used in simulations cover educational interventions focused on observed behaviors, or patient outcomes.[12]

In addition, the use of actors who are students with experience in clinical training using simulation scenarios has been useful for them since the knowledge acquired during the clinical experience is valid, as seen in the debriefing.[13]

This study's limitations include the modest sample size, which prevented comparing knowledge between nurses who acted in the scenarios and those who observed. Another limitation is the use of the convenience sampling technique at only one hospital, which limits the generalization of results. Finally, this study did not evaluate all participants' team performance, considering that other teams may present better knowledge and performance.

5. Conclusion

The findings indicate that the educational intervention based on theory effectively enhanced nurses' knowledge of ENT in their clinical practice. This study also showed that nurses who played a role in the scenarios and those who were observers (without using an instrument to guide their assessment) achieved positive results and reported that the simulation was relevant and promoted pragmatic attitudes toward their role as nurses.

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Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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