

Original Research Article

Impact of a “Golden Hour” Educational Intervention on Knowledge, Attitudes, and Practices Among Nursing Staff in Pediatric Emergency Departments Caring for Patients with Acute Lymphoblastic Leukemia

Briseida Sarai Xalamihua Serrano¹ , Claudia Izbeth Dimas Reséndiz¹ , Olga Rocío Flores Chávez¹ ,
María del Carmen López Zermelo² , Leticia Carolina Hernández Esparza² , Jesús Carlos Ruvalcaba
Ledezma³ , Claudia Teresa Solano Pérez⁴ , David Pérez Becker⁴ , Josefina Reynoso Vázquez⁵ 

Department of Nursing, Institute of Health Sciences, Autonomous University of the State of Hidalgo, Mexico

CUCS University Center for Health Sciences. Regional Public Health Research Institute. University of Guadalajara Mexico

Independent researcher and former professor in the Department of Medicine and Master's in Public Health, Institute of Health Sciences, Autonomous University of the State of Hidalgo, Mexico

Department of Medicine. Institute of Health Sciences, Autonomous University of the State of Hidalgo, Mexico

Department of Pharmacy and Master's Program in Public Health. Institute of Health Sciences, Autonomous University of the State of Hidalgo, Mexico

Corresponding Author: Josefina Reynoso Vázquez

Email: jreynoso@uaeh.edu.mx

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Abstract

The “golden hour” is an international protocol, spearheaded by St. Jude Children’s Research Hospital, for the management of pediatric cancer patients (ALL). Objective: To evaluate the impact of an educational intervention on nursing staff regarding the implementation of the “golden hour” protocol for patients with acute lymphoblastic leukemia (ALL). Methodology: A quasi-experimental study was conducted based on a quality improvement model that employs a collaborative approach and continuous improvement methodology. The study was carried out in emergency departments at various hospitals among 110 nurses working different shifts and was conducted in three phases: Phase I: adaptation and validation of the measurement instrument to assess participants’ knowledge level before the educational intervention; Phase II: design and implementation of a training program through theoretical and practical sessions on the “Golden Hour” protocol; and Phase III: assessment of participants’ knowledge before and after training and evaluation of the educational program’s impact. Descriptive and comparative statistical analysis was performed using SPSS version 30.0. Results: Before the educational intervention, 71% of participants were at the low level, 25% at the medium level, and 4% at the high level. Following the educational intervention, the high level reached 89%, the medium level decreased to 5%, and the low level to 1%. Conclusions: Following the implementation of the educational intervention, a significant improvement was observed in knowledge, attitude, and practice regarding the “golden hour” protocol in the care of pediatric patients with Acute Lymphoblastic Leukemia (ALL). There was a significant increase in understanding of key timeframes, warning signs, and essential therapeutic measures during the first hour of care, as well as a greater ability to prioritize key interventions, such as the timely administration of antibiotics, monitoring of vital signs, and identification of early complications, such as septic shock.

Keywords: Educational intervention, Golden Hour, Febrile Neutropenia, Pediatric patients with ALL.

Introduction

Acute Lymphoblastic Leukemia (ALL) is the most common malignant neoplasm affecting primarily pediatric patients, posing a significant challenge to health care systems due to its high incidence and the complications associated with its treatment. It is one of the most common cancers in children, accounting for 25% of all childhood cancers. It represents between 0.5% and 3% of all malignant neoplasms worldwide [1]. This disease is characterized by the abnormal proliferation and differentiation of a clonal population of lymphoid cells, which generally results in impaired bone marrow function and local infiltration, leading to uncontrolled proliferation of immature white blood cells in the bone marrow (BM) and blood, as well as infiltration of other tissues such as the liver, spleen, and lymph nodes, among others [1].

Fever and neutropenia are common clinical manifestations at the onset of pediatric ALL. Fever is present in 45–52.8% of cases, while neutropenia is documented in 60–68% of cases at the time of disease presentation. The simultaneous occurrence of these symptoms, known as febrile neutropenia (FN), is a common complication in cancer patients receiving high-intensity chemotherapy, as is the case in the treatment of ALL. Furthermore, it is a condition that occurs in children with ALL at the time of diagnosis and before they receive cancer treatment [2]. The clinical significance of febrile neutropenia lies in the high risk of serious infections, sepsis, and life-threatening complications due to the body's diminished immune response.

Early administration of broad-spectrum antibiotics has been associated with a significant reduction in mortality and progression to more severe clinical states, making response time a key indicator of quality in medical care [2]. Access to effective interventions and the optimal use of treatment protocols have increased survival rates for patients with ALL to approximately 70–100%, primarily due to a decrease in mortality associated with infections and relapses [3].

In 2013, nurse Mitzy Romano Gorostieta designed a protocol in collaboration with the medical and nursing staff at Tijuana General Hospital [4]. This protocol, known as the “golden hour,” plays a fundamental role; it refers to the period of time that healthcare personnel have to assess a patient, whether febrile or non-febrile, with or without neutropenia, during which interventions are critical to improving clinical outcomes. In 2018, the WHO, with the help of St. Jude Children's Research Hospital, launched a global partnership against childhood cancer, which offers technical assistance to help establish and maintain high-quality childhood

cancer programs. The goal is to achieve a 60% survival rate for children with cancer by 2030, effectively doubling the current rate and saving one million more lives over the next decade [5].

The goal of the “golden hour” protocol is to ensure that all children with cancer who present to the emergency department (or equivalent) with a fever receive timely and effective treatment, which would reduce the risk of severe treatment-related infectious complications. This protocol aims to provide patient-centered care and optimize treatment. The specific goal of the Golden Hour protocol is to ensure that at least 70% of febrile hematologic-oncology patients (P-HOPf) who present to the emergency department receive their first dose of antibiotics within 60 minutes of the initial clinical evaluation [6].

The effectiveness of implementing the “golden hour” protocol in pediatric patients with ALL depends largely on the competence and knowledge of the nursing staff. Furthermore, ALL remains a significant challenge in the field of oncology, particularly in pediatric treatment, highlighting the importance of accurate risk stratification and targeted therapies to improve clinical outcomes [7].

However, there is evidence that temporary nursing staff may face challenges in properly implementing this protocol due to a lack of skills, knowledge, or experience with it.

In this regard, timely and accurate care during the golden hour can affect the survival and quality of life of pediatric patients with ALL. Therefore, it is crucial to evaluate the effectiveness of an educational program aimed at temporary nursing staff to improve the implementation of the protocol.

Consequently, this study aims to evaluate the impact of an educational intervention on nursing staff regarding the implementation of the “golden hour” protocol for patients with acute lymphoblastic leukemia (ALL).

This study proposes the following working hypotheses: the null hypothesis, which states that the educational intervention does not alter the level of knowledge, and the alternative hypothesis, which states that the educational intervention significantly increases the level of knowledge.

Methodology

Study design. A quasi-experimental study was conducted. The model implemented was based on continuous improvement strategies that made it possible to evaluate interventions in real time among the nurses

who participated in the study, using structured indicators. Measurement became a key component for identifying areas of opportunity, monitoring progress, and supporting clinical and administrative decision-making.

Population and Sample

The study population consisted of nursing professionals who rotated through the emergency departments of various hospitals. The sample comprised 110 participants selected through non-probabilistic convenience sampling, based on the following criteria:

Inclusion criteria.

- Nursing professionals assigned to or rotating through the emergency department.
- Staff with technical, bachelor's, or specialty-level academic qualifications.
- Staff working morning, afternoon, night, and cumulative shifts.

Exclusion criteria.

- Nursing students.
- Nursing interns.
- Administrative staff without patient care duties.

Elimination criteria.

- Participants who chose to voluntarily withdraw from the study.
- Questionnaires that were incomplete or contained inconsistent information.

Statistical analysis

For the analysis, descriptive statistics were calculated, as well as comparative analyses before and after the educational intervention, using the Statistical Package for the Social Sciences (SPSS), version 30.0.

Bioethical aspects

The development and implementation of this strategy are based on the bioethical principles of beneficence, nonmaleficence, justice, and respect for autonomy.

The intervention seeks to maximize clinical benefit by ensuring timely care and reducing risks associated with delays in treatment. Likewise, it promotes nonmaleficence by standardizing evidence-based practices that reduce the likelihood of adverse events.

Regarding confidentiality, the data collected comes from medical records and is handled in accordance with strict data protection criteria, preventing the disclosure of personally identifiable information. Each participating institution is responsible for safeguarding patient privacy in accordance with current regulations.

The principle of justice is reflected in the implementation of strategies aimed at improving the quality of care in an equitable manner across different hospital settings.

Since this is a quality improvement initiative rather than an experimental research project, the data is used to strengthen care processes, while complying at all times with the applicable regulatory and ethical frameworks.

Results

Sociodemographic Characteristics of the Population

A total of 110 nursing professionals who rotated through the emergency department at various hospitals participated. Of the total participants, 55.4% were female and 44.5% were male. In terms of age, the 28- to 33-year-old group was the largest.

Table 1 shows the sociodemographic data (gender, age, and group) of the study population. The sample is balanced by gender, suggesting that the results are not biased by this factor.

Table 2 shows the participants' educational levels; 62 of the 110 participants held a bachelor's degree.

Phase I: Adaptation and Validation of the Measurement Instrument

To assess participants' level of knowledge regarding the management of cancer patients requiring timely intervention under the Golden Hour protocol, an adaptation was made of the questionnaire titled "Consensus on the Management of Febrile Neutropenia in Pediatric Oncohematological Patients" (CMFNPOP), which initially consisted of 11 items; however, for the purposes of this study, the questionnaire was adapted by restructuring it and increasing the number of items from 11 to 15.

Validation of the instrument

The validity stages of the instrument are shown in Table 3. Once adapted for this study, a panel of experts in pediatric oncology nursing, infectious diseases, and research methodology reviewed the instrument to ensure the appropriateness, clarity, and relevance of the items. A pilot test was then conducted with a small group of professionals to verify its comprehensibility and reliability, allowing for the necessary adjustments to be made before its final administration.

The aspects related to social desirability (response induction), clear instructions, logical sequence, and number of items reported a mean value below 0.8 on a scale of 1, as shown in Table 4, highlighting areas for

Table 1. Sociodemographic Characteristics of the Population by Sex, Age, and Grade Level

Sex of the target population	No	%	X2	p
Female	61	55.4		
Male	49	44.5		
Total	110	100	4.5	0.32
Age groups in the population				
22	15	14.6		
25	16	8.7		
28	24	29.1		
33	35	26.2		
35	20	12.6		
Total	110	100	11.2	0.04 *

Table 2. Educational Level of Participants

Educational Level	No	%	X2	p
Technical degree	18	23.3		
Bachelor's degree	62	18.4		
Specialist	30	26.2		
Total	110	100	18.3	0.02 *

improvement. This was supplemented by qualitative observations made by the experts on the items they highlighted, which were then grouped according to the questionnaire's conceptual components.

Consequently, the need to redesign the instrument based on questions related to the topic was identified. To address the comments that were made, questions 4, 6, and 10, which provided duplicate information or showed a low correlation with other items, were redesigned. Consequently, the internal consistency of the instrument achieved a Cronbach's alpha value of 0.83 for a total of 11 modified items. This adjustment allowed the instrument to be better understood and accepted by the target population, as shown in Table 5.

The results obtained in the previous stages demonstrated adequate internal consistency of the instrument, with a Cronbach's alpha coefficient of 0.833 after the items were refined and adjusted. This result indicates adequate homogeneity among the items and a reliable measurement of the construct being assessed. The expert review identified that the items were grouped into conceptual dimensions related to knowledge of febrile neutropenia, recognition of warning signs, application of the Golden Hour protocol, and priority nursing interventions. These dimensions were consistent with the theoretical foundations underpinning the care of pediatric hematologic-oncologic patients. A comprehensive evaluation of the instrument confirmed the appropriateness, clarity, and relevance of the items for measuring nursing staff knowledge regarding the timely management of pediatric patients with acute lymphoblastic leukemia

who require care under the Golden Hour protocol. The findings support the instrument's utility as a valid and reliable tool for evaluating educational programs aimed at strengthening clinical competencies in pediatric emergency departments and oncology care settings.

Phase II: Educational Intervention

The educational intervention took place over six months, from October 2024 to April 2025. It consisted of a structured training program comprising theoretical and practical sessions focused on the timely recognition of febrile neutropenia, the identification of warning signs, the implementation of the Golden Hour protocol, the early administration of antibiotics, and the prevention of complications associated with sepsis. Activities included lectures, clinical case analyses, problem-solving exercises, group discussions, and simulations of scenarios related to the care of pediatric hematology-oncology patients. An assessment tool was administered before and after the program to measure the participants' level of knowledge.

Phase III: Interpretation of Results Before and After the Educational Intervention

Prior to the educational intervention, 71% of participants were classified as having a low level of knowledge, 25% as having a moderate level, and 4% as having a high level. Following the educational intervention, there was a significant increase in the high knowledge level, which reached 89%, while the moderate level decreased to 5% and the low level to 1%, as shown in Table 4. The educational intervention not only allowed for the evaluation of quantitative results but also facilitated learning.

Real-time data analysis facilitated the identification of barriers, the implementation of changes, and the evaluation of the effectiveness of the "golden hour" protocol. This study provided measurement, analysis, and action results that are fundamental to achieving sustainable improvements for patients with ALL who require timely

Table 3. Validity Stages of the Instrument

Stage	Objective	Sample
Stage 1 Construct Validity	Construct validity of the instrument, assessed by expert judges	2 judges specializing in pediatrics, 2 in general medicine, 3 in oncohematology, 2 in oncology nursing, and 2 education professors.
Stage 2 Reliability Analysis	Validation of the instrument's reliability	200 nurses
Reliability Analysis	Reliability validity of the re-designed instrument (including judges' observations)	200 nurses
Stage 3 Exploratory and confirmatory factor analysis Final reliability analysis.	Definition of components (reliable Cronbach's alpha)	

Table 4. Cronbach's alpha values and reliability coefficients for the measurement instrument

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of items
0.742	0.699	

Table 5. Item Descriptive Statistics

ITEM	MEAN	STANDARD DEVIATION	N
1	1.87	0.75	200
2	2.10	0.83	200
3	2.37	0.82	200
4	1.14	0.47	200
5	2.14	0.75	200
7	1.27	0.50	200
8	2.13	0.85	200
9	2.09	0.68	200
10	2.27	0.64	200
11	1.75	0.82	200

care. Furthermore, the integration of data from multiple institutions enabled the generation of large-scale evidence, strengthening decision-making and promoting the adoption of best practices in various contexts, as shown in Table 6.

A significant increase in knowledge was observed following the intervention ($p < 0.001$).

The results suggest that the educational intervention significantly strengthened the nursing staff's ability to identify critical elements of the Golden Hour protocol, including the early recognition of warning signs, the prioritization of care, and the timely administration of therapeutic interventions.

Furthermore, the implementation of continuous improvement strategies made it possible to identify areas for improvement in care processes, promoting the standardization of clinical practices aimed at the safe and timely care of pediatric hematology-oncology patients.

Discussion

The results of this study demonstrate that a structured educational intervention significantly improved nursing staff knowledge regarding the implementation of the "golden hour" protocol for patients with ALL. The findings highlight the importance of implementing structured assessment strategies to improve the quality of care for pediatric patients with cancer [9].

The systematic review published in Healthcare identified that continuing education is an essential component for maintaining professional competence in oncology nursing, as it improves clinical performance, strengthens patient safety, and facilitates the incorporation of evidence-based recommendations. These findings support the increase in knowledge documented in the present study and suggest that continuing education should be considered an essential element in institutional quality programs [10].

A study conducted at a teaching hospital in southwestern Brazil demonstrated that the implementation of a "Golden Hour" protocol depended on an organized process that included a situational assessment, participatory protocol development, training sessions, protocol implementation, and continuous monitoring of outcomes. The authors emphasize that training was the main facilitator for the protocol's implementation; they also concluded that continuing education is indispensable for consolidating changes in clinical practice and achieving better outcomes [11].

In addition, in 2022, the St. Jude Global Mexico Regional Program and the Institute for Healthcare Improvement (IHI), through the "Golden Hour" initiative,

Table 6. Adjusted Cronbach's α values and reliability coefficients

ITEM	Scale mean if the item is removed	Scale variance if the item is removed	Adjusted item-total correlation	Cronbach's alpha if the item is removed
1	15.74	12.75	.528	.702
2	15.51	12.33	.530	.700
3	15.24	13.53	.418	.738
4	15.77	12.58	.559	.797
5	15.57	12.99	.480	.725
6	15.78	13.25	.307	.711
7	15.58	13.19	.230	.724
8	15.86	13.79	.143	.746
9	16.21	14.14	.150	.733
10	15.57	12.44	.157	.745
11	15.85	12.31	.147	.754
Cronbach's alpha				0.833

Table 7. Level of Knowledge Before and After the Educational Intervention

Level of knowledge	Before intervention n (%)	After intervention n (%)
High	4%	89%
Medium	25%	5%
Low	71%	1%
Total	100%	100% 0.005

provided training on quality improvement methods, tools, and skills via virtual and in-person workshops called “Learning Sessions,” implemented in collaboration with hospitals in Mexico and later expanded to various hospitals throughout Latin America. Thanks to these interventions, the percentage of pediatric cancer patients with fever who received the first dose of antibiotics within the first 60 minutes increased from 47% to 79%, while the incidence of sepsis decreased from 16% to 6%, resulting in a significant increase in the level of knowledge regarding the application of the “Golden Hour” protocol in pediatric patients with ALL. The findings of this study support the conclusion that educational interventions are a fundamental component of the effective implementation of the “Golden Hour” protocol, demonstrating that training and the organization of care processes can lead to better clinical outcomes [12,13].

Similarly, a study conducted at Tijuana General Hospital implemented a three-phase multimodal improvement strategy (execution, consolidation, and sustainability) called “Golden Hour” to reduce the time to antibiotic administration in pediatric oncology patients with febrile neutropenia, resulting in increased compliance with the indicator for antibiotic administration within 60 minutes and a significant reduction in episodes of sepsis and other infectious complications. This highlights the importance of ongoing training for healthcare personnel, coupled with organizational interventions and standardized protocols, which is an

indispensable element for improving the quality of care [14].

These results highlight the importance and necessity of ongoing educational programs, as well as the standardization of protocols to optimize care for pediatric patients with ALL and other oncological conditions [15]. However, implementation faces challenges related to variability in resources, organizational culture, and the ongoing training of nursing staff [16].

Finally, it would be necessary to consider the recommendation of psychological interventions for the management of psychoneuroimmunological markers of pediatric cancer [17].

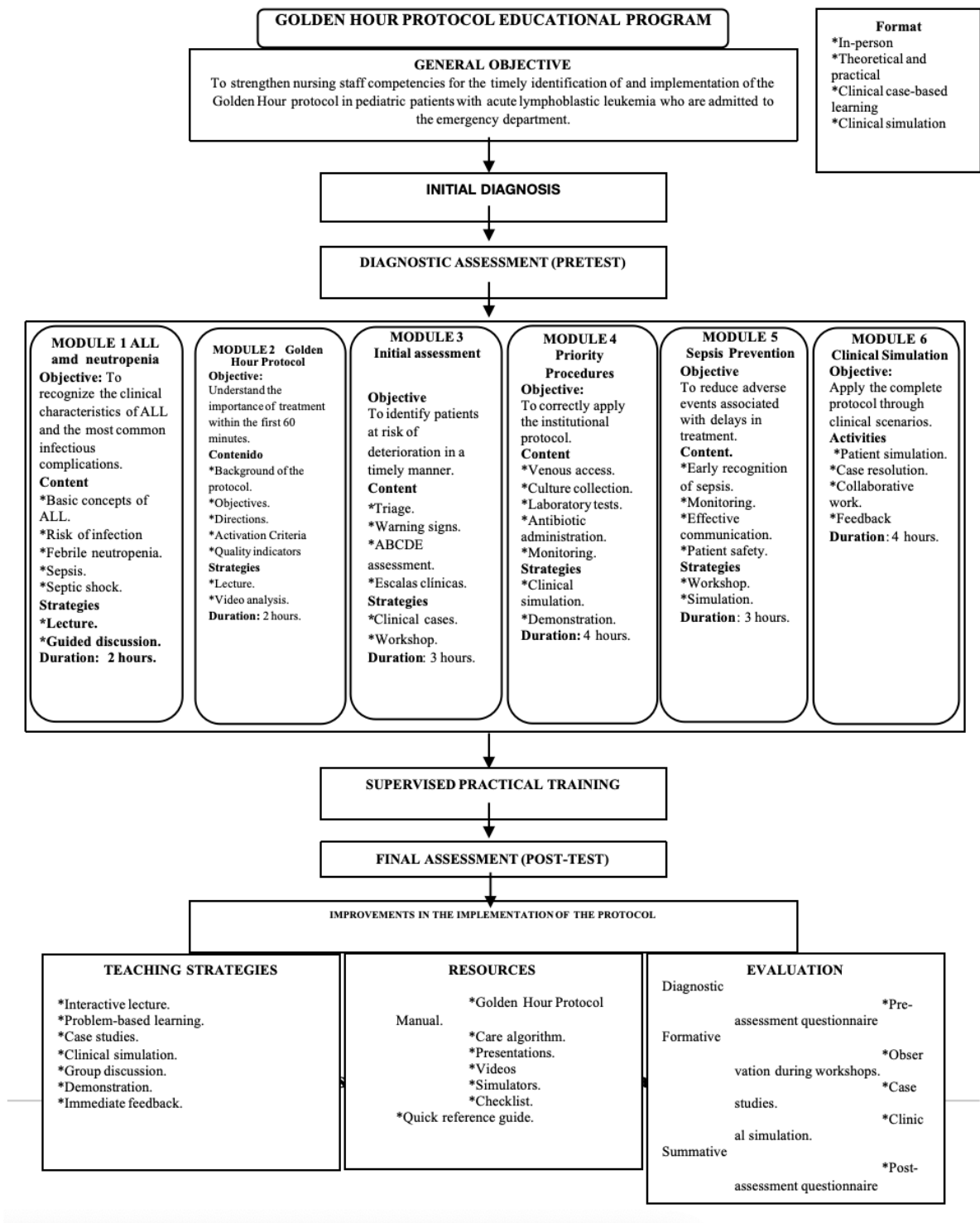
CONCLUSION

The implementation of an educational intervention based on quality indicators made it possible to optimize care processes for pediatric hematologic-oncology patients with ALL.

Before the program, knowledge of the protocol was limited, and only a small percentage of staff correctly identified the critical steps in initial management. However, following the intervention, a significant increase was observed, revealing a relationship between the timeliness of treatment and a reduction in adverse events, such as the development of sepsis, the need for critical interventions, and patient admission to intensive care units.

This study demonstrates that targeted continuing ed-

Outline of the Golden Hour Protocol Educational Program



Education is key to strengthening clinical competencies, particularly among temporary staff who frequently rotate through departments, thereby helping to reduce clinical complications and enhance quality of care and patient safety.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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