OPEN ACCESS
Saudi Journal of Nursing and Health Care
Abbreviated Key Title: Saudi J Nurs Health Care
ISSN 2616-7921 (Print) |ISSN 2616-6186 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Effectiveness of an Educational Program on Intensive Care Unit Nurses' Knowledge Regarding Systemic Inflammatory Response Syndrome

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DOI: 10.36348/sjnhc.2022.v05i10.007 | **Received:** 06.09.2022 | **Accepted:** 17.10.2022 | **Published:** 20.10.2022

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Abstract

***Background*:** During triage in the emergency room, observations of vital signs and identification of organ failure are increasingly frequently employed to diagnose systemic inflammatory response syndrome (SIRS) and sepsis. However, there is less emphasis on early detection technologies of systemic inflammatory response syndrome (SIRS) in the critical care unit. ***Method*:** This is A prospective research design study, A convenience sample technique utilized consists of (45) nurses working in the intensive care unit at King Khalid general hospital, KSA. Participants completed the electronic questionnaire sheet to assist knowledge of nursing staff about Systemic Inflammatory Response Syndrome by pre, immediate, and post educational program consisting of twenty questions. ***Results*:** The findings show a highly statistically significant increase in the mean score in a knowledge level of knowledge before and immediately after the educational program, then it slightly decreases one month after the educational program. There was no statistically significant relationship between the total knowledge of studied nurses and their Sociodemographic Characteristics. ***Conclusion*:** Criteria for systemic inflammatory response syndrome (SIRS) are very important to know and, unfortunately, they are not well used in ICU. It is recommended that educational programs be provided for intensive care nurses to help them with the detection of sepsis in the early stages.

Keywords: Effectiveness of an Educational Program - Intensive Care Unit -Nurses' Knowledge -Systemic Inflammatory Response.

1. INTRODUCTION

Systemic inflammatory response syndrome" (SIRS) was used to characterize the complicated pathophysiologic response to insults such as infection, trauma, burns, pancreatitis, and other diseases (Balk., 2014). Sepsis is a systemic inflammatory response to an infection either confirmed or suspected infection (Comstedt *et al*., 2009a). It is one of the greatest causes of death and medical disorders for intensive care patients (Churpek *et al*., 2017). As well as the Multiple organ failure (MOF), is the commonest reason of mortality in the intensive care unit (ICU) (Singer., 1998). A current Global Burden of Disease Study on sepsis estimated 2017 about 48.9 million cases of sepsis worldwide, with 11.0 million sepsis-related deaths (Choy *et al*., 2022). Multiple organ failure and the systemic inflammatory response syndrome are challenges to medical progress and intensive care units (ICUs) and involve the prevention of organ failure through excellent care to the patients (E. Baue., 1994). In addition, healthcare strategy and exploration have been aimed at the early identification and treatment of sepsis to improve patient outcomes (Churpek *et al.*, 2017).

1.1 PROBLEM STATEMENT

The most important thing in improving the outcome of patients with sepsis is early detection and early intervention. Many patients in the intensive care unit deteriorated rapidly and may be developed sepsis or septic shock and died. Also, there are no screening scores for predicting sepsis in the ICU as there are in the ER, so it is difficult to detect sepsis immediately. The nursing in ICU is closer to the patients than other health care professionals and they have more responsibility to reduce mortality and save the patient live from sepsis. That is why it is important to be aware of the early warnings scores for detection of sepsis,

especially SIRS which is very simple and easy to detect sepsis early.

1.2 RESEARCH OBJECTIVES

The study aimed to evaluate the effect of an implementing Educational Program on Intensive Care Unit Nurses' Knowledge Regarding Systemic Inflammatory Response Syndrome at King Khalid General Hospital in Hafr Albatin.

1.3 RESEARCH HYPOTHESES

Nurses' knowledge level regarding Systemic Inflammatory Response Syndrome would be significantly improved after implementing an educational program than their level before.

2. LITERATURE REVIEW

'Sepsis' is the term of describes the systemic inflammatory response to a confirmed or suspected infectious disease (i.e. viral, bacterial, fungal, or parasitic) (BalcI *et al*., 2002) (Comstedt *et al*., 2009b). According to the current definition, it is also defined as organ dysfunction induced by a dysregulated host response to infection (Adegbite *et al*., 2021). Organ failure can result from the body's systemic reaction to infection, and it can happen to any patient in the hospital (Schorr *et al*., 2016).

Between 1991 and 2016, the criteria for sepsis changed dramatically (Adegbite *et al*., 2021). There are many early warnings scores for predicting sepsis among infected patients like National Early Warning Score (NEWS), Modified Early Warning Score (MEWS), Mortality in Emergency Department Sepsis score (MEDS), Search Out Severity score (SOS), Quick Sequential Organ Failure Assessment (qSOFA) and Systemic Inflammatory Response Syndrome (SIRS) (Wattanasit, P., & Khwannimit, B, 2021).

During a 1991 consensus conference, Bone and colleagues proposed the systemic inflammatory response syndrome (SIRS) with the goals of enhancing the early detection of patients with sepsis, enabling standardization of research techniques, and providing important prognostic information (Churpek *et al*., 2015). The SIRS criteria have been widely accepted in research and clinical practice since then. On the other hand, the value of SIRS has been questioned, with most criticisms centered on the criteria's low specificity (Churpek *et al*., 2015). Many non-infectious diseases, such as pancreatitis, myocardial infarction, and pulmonary embolism, can lead to the development of SIRS. Furthermore, even moderate activity can help to achieve the SIRS criteria for heart rate and respiratory rate. In addition, the SIRS criteria are still widely utilized in sepsis bundles and as a diagnostic tool access standards for scientific trials (Churpek *et al*., 2015). Systemic inflammatory response syndrome (SIRS) standards have been posted in 1992 and encompass numerous parameters along with frame temperature better than 38 °C or lesser than 36 °C, heart rate better than 90/min, respiration rate better than 20/min or PaCO2 lesser than 32 mmHg and white blood cell rely better on than 12,000 cells/µl or lesser than 4000 cells/µl (van den Hengel *et al*., 2016). Sepsis has been described as suspected or confirmed infection through having at the least two symptoms of systemic inflammatory reaction syndrome (SIRS) (Torsvik *et al*., 2016).

Systemic Inflammatory Response Syndrome (SIRS) Criteria

- Temperature > 38 or < 36 °C
- Heart rate > 90/min
- Respiratory rate > 20/min
- White cells < 4 or > 12 × 10^9/L
- Acutely altered mental status
- Hyperglycaemia (glucose > 7.7 mmol/l) (in non-diabetic)

Box 1: Systemic Inflammatory Response Syndrome (SIRS) Criteria. Adapted from Daniels and Nutbeam (2017).

Sepsis is a leading cause of morbidity and mortality in intensive care units (ICUs), due to a rise in invasive operations, immunosuppressive medicines, chemotherapy, transplants, and a lack of early detection and timely treatment of sepsis in the emergency department (ED). The severity of organ dysfunction and failure affects the outcome of sepsis, and the mortality rate rises as the severity of organ dysfunction and failure increases (Zhang *et al.*, 2019).

Depending on the etiology, sepsis has a wide range of clinical manifestations. The respiratory, genitourinary, and gastrointestinal systems and the skin and soft tissue are the most prevalent sites of infection (El Sayed & Ahmed, 2017). Sepsis, defined as a

dysregulated host response to infection that leads to life-threatening organ failure, has been designated as a global health priority by the World Health Organization (WHO). According to the latest Global Burden of Disease, Study on sepsis, there were 48.9 million cases of sepsis worldwide in 2017, with 11.0 million deaths (Choy *et al*., 2022). Sepsis is still a big health concern around the world (McCoy & Das, 2017). it affects 19 million people each year, with the majority of cases occurring in low- and middle-income nations. Severe sepsis has a mortality rate of 25 percent to 30 percent, while septic shock has a mortality rate of 40 percent to 70 percent (El Sayed & Ahmed, 2017). Sepsis affects around 750,000 people in the United States each year, resulting in 215,000 fatalities at a cost of more than $16 billion. Severe sepsis patients account for 45 percent of all intensive care unit (ICU) bed days and 33% of all hospital bed days (Bajracharya *et al*., 2020).

Patients with a suspected infection have had their vital signs and organ function inadequately monitored for the onset of sepsis (Torsvik *et al*., 2016). Early detection of sepsis is a challenge for many healthcare systems (McCoy & Das, 2017). Because physicians and health care teams may delay disposition choices in the hopes of avoiding ICU admissions through resuscitation, the lack of techniques to identify patients who may require ICU-specific therapies or nursing care leads to confusion during disposition and may contribute to prolonged ED stays (Murphy *et al*., 2019). Early identity of sepsis and the well-timed implementation of goal-directed remedies drastically lower sepsis-associated mortality and are cost-effective, highlighting the need for new medical techniques to resource or help in early diagnosis (Gyang *et al*., 2016).

Critical care Nurses, who're at the bedside of patients in the hospital, are in a cardinal role to discover early-degree sepsis and improvement of organ failure, yet they have not been central to the sepsis campaign. It isn't regarded how a scientific continuation of observations of SIRS and organ failure in hospitalized patients with suspected or shown contamination will affect the prognosis of patients with sepsis (Torsvik *et al*., 2016). Critical care nurses play an important role in identifying symptoms and starting a management plan that includes the level of observation, review schedule, and implementation plan. Therefore, all intensive care nurses need to be aware of sepsis development. Critical care nurses are the health care specialists responsible for protecting critically ill patients against infection, especially that leading to sepsis, promoting patients' recovery, and preventing deterioration in their health. Intensive care nurses play a critical role in the prevention, early detection, and starting of therapeutic interventions in patients with sepsis (El Sayed & Ahmed, 2017). That is why it is very important for them to know the SIRS scoring and how to identify the symptom early to protect the patient from the risk of sepsis and multiple organ systems. Especially in the nursing chart, there is nothing that can give a warning sign to give them like an alarm that a patient is going to have sepsis.

Improving the knowledge and awareness of SIRS among healthcare specialists will help to reduce the mortality of sepsis. This can be reached through education and training, the training involving the early detection of sepsis.

This study will evaluate the Effectiveness of An Educational Program on Intensive Care Unit Nurses' Knowledge Regarding Systematic Inflammatory Response Syndrome at King Khalid General Hospital in Hafr Albatin.

3. MATERIALS AND METHODS

3.1 STUDY DESIGN

A quasi-experimental design was used to accomplish the aim of the study.

3.2 SETTING.

The study was carried out in the intensive care unit at King Khalid general hospital in hafr Albatin, KSA. Which includes twenty-one beds, and it has medical and surgical cases.

3.3 SUBJECT

The study includes intensive care nurses working in the previously mentioned setting. A convenience samples technique utilized consists of (45) ICU nurses' staff of both gender Saudi and non-Saudi available at the time of data collection from April 2022 until May 2022.

Inclusion criteria:

All male and female Saudi and non-Saudi registered nurses who are working in the intensive care unit at King Khalid general hospital, hafr al batin during the period of data collection are included in the current study.

Exclusion criteria:

Nurses who are on vacation leave during the period of data collection, nurses who are working in other departments, student nurses, assistant nurses, and internships will be excluded.

3.4 TOOLS OF STUDY.

One tool was used: A structured questionnaire for nurses: it was developed by the researcher to collect the necessary data and consists of 3 parts as follows:

- **Part (I): Socio-demographic characteristics** developed by the researcher contains 5 questions Related to age, sex, nationality, qualification, marital status, and years of experience.
- **Part (II): Previous educational program** This part was designed by the researcher to

assess nurses' information regarding Systemic inflammatory response syndrome and consisted of 2 questions.

- **Part (III): Electronic questionnaire sheet to assist knowledge of nursing staff about Systemic Inflammatory Response Syndrome** by pre, immediate, and post educational program consisted of 20 questions developed by the researcher based on reviewing related literature (El Sayed & Ahmed, 2017) by using google form program. It takes 20 to 30 minutes

SCORING SYSTEM

Knowledge gotten from nurses was scored and calculated according to the answers, it was evaluated by using a model key answer sheet prepared by the researcher. Each question ranged from 0-1 score, while the right answer was given one score, and the wrong answer was given zero scores, with a total of (20) scores, converted into a percent score (100%). It is considered as follows**:**

- A score ≥ 85% is regarded as a satisfactory level of knowledge as "good knowledge"
- A score between 85 -65% is regarded as "Fair knowledge".
- A score of < 65% is regarded as an unsatisfactory level of knowledge or " poor knowledge".

3.5 STUDY METHODS

The study was conducted over one month from April 7, 2022, until May 7, 2021. it was carried out by the researcher through three phases: -

Assessment phase (The pre-educational program): - was given an electronic questionnaire content of 20 questions to all staff to assess their knowledge regarding Systemic Inflammatory Response Syndrome they answer the sheet within 30 mins.

Implementation phase: - Nurses are divided into groups each group contains 15 nurses per day according to the total number of nurses (45), given an educational program for three days, the program Content of 3 sections.

- **Section (1)** was a systemic inflammatory response syndrome overview; it takes 30 minutes to define the SIRS to the staff.
- **Section (2)** was about the risk factor, causes, and Complications of the systemic inflammatory response system it takes 45 mins
- **Section (3)** was about the most prober score for measurement of the systemic inflammatory response system it takes 45 mins

Evaluation phase:

a. Immediately after the educational program given the same pre-educational electronic questionnaire to assess the effectiveness of the method used during the lecture and to assess their knowledge takes 30 mins.
b. Follow-up after one month, given the same electronic questionnaire to evaluate and assess the knowledge regarding systemic inflammatory response syndrome.

ETHICAL CONSIDERATIONS:

The official letter for data collection was taken from the previously mentioned setting. the aim of the study has been explained to all nurses. They were also informed that their participation was optional, and they were assured that all data was confidential and would be used only for study purposes. Nurses were explained that they were allowed to participate or not in the study and they could withdraw from the study at any time without giving any explanation.

TOOL VALIDITY:

The tool validity was established for clarity, comprehensiveness, accuracy, understanding, and simplicity and considered the aim of this study by a panel of four experts from the faculty of the nursing department at Hafr Albatin University, and all modifications were done according to their comments.

TOOL RELIABILITY:

The designed tool of the study was tested statistically for reliability by using Cronbach's alpha test to measure its internal reliability for the study sample size (45) staff nurses. The reliability score of the tool was 0.724. This means that the scale of the study has a very high stability and credibility that can be relied upon in the field application of the study.

The scale	No. of items	Cronbach's Alpha coefficient
Nurses' knowledge	20	0.724

LIMITATION OF THE STUDY:

This study started in Ramadan, and because of the different times, sometimes it was difficult to collect the complete group for the educational sessions. That's why it takes three days to give an educational program every day to 15 nurses.

STATISTICAL ANALYSIS:

Data were collected, reviewed ,coded, organized, formulated, and analyzed by using Statistical Package for Social Sciences (SPSS) version 20 .using frequencies, numbers, percentages, mean and standard deviation. Data were produced in the form of tables and figures.

4. RESULTS

Table 1 shows staff nurses' sociodemographic characteristics. The age of staff nurses ranged between 20 and 49 years, with a mean of 34.91± 8.32 representing that (37.8%), which is a higher percentage of them aged 20–29 years old as compared to (30–39) years old, the majority of the nurses were female (95.6%). Staff nurses 66.7% were non-Saudi compared to 33.3% were Saudi. Regarding the qualifications, it was found that (80%) had bachelor's degrees while (20%) had diploma degrees. Concerning years of experience in ICU, the min= 1 year and max= 22 years of experience, 51.1% of them had 1–5 years of experience.

Table 1: Distribution of the studied nurses according to their sociodemographic characteristics (n=45)

Sociodemographic Characteristics of the study subject Study subject = 45		No	%
Age	≤20- 29 years	17	37.8
	30- 39 years	17	37.8
	40- 49 years	11	24.4
Mean ± SD = 34.91± 8.32 Min =25years Max= 49 years			
Sex	Male	2	4.4
	Female	43	95.6
Nationality	Saudi	15	33.3
	non-Saudi	30	66.7
Qualification	Diploma	9	20.0
	Bachelor	36	80.0
Marital status	Single	19	42.2
	Married	25	55.6
	Divorced	1	2.2
Years of experience in ICU?	≤1 year.	2	4.4
	1-5 years	23	51.1
	6-10 years	6	13.3
	≥11 years	14	31.1
Mean ± SD = 8.86± 7.32 Min =1years Max= 22 years			
Total		45	100.0

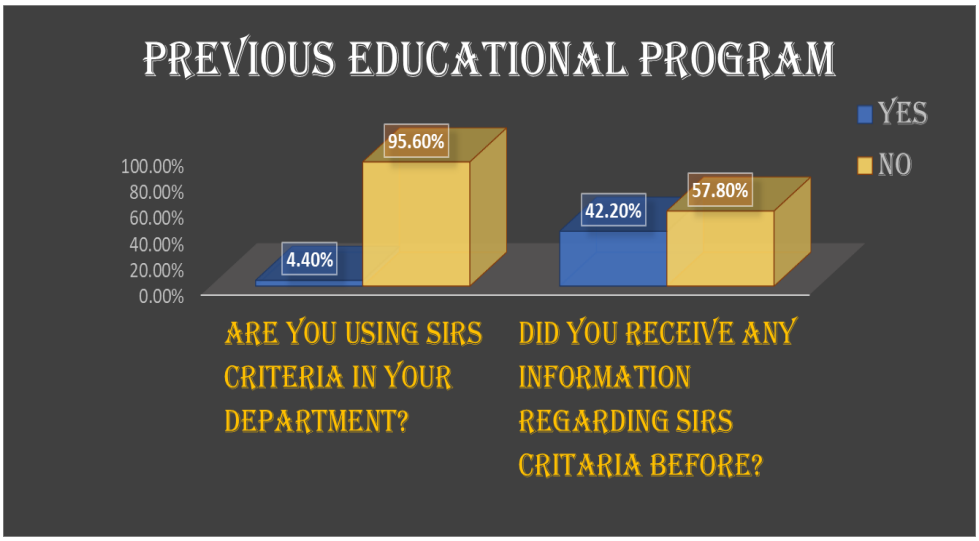

Figure 1: Percentage of studied nurses who used SIRS criteria and who received information about SIRS criteria before (n=45)

Figure 1 shows that 95.60% of the studied nurses agreed that they are not using SIRS criteria in their department while 4.40% represent the number two nurses who said that they are using SIRS criteria. It shows also that 57.80% of studied nurses did not receive any information before regarding SIRS criteria, while 42.20% received information regarding SIRS criteria.

Table 2 the findings show a highly statistically significant increase in the percentage of all correct answers before and immediately after the educational program, then it slightly decreases one month after the educational program.

Table 2: Demonstrate the percentage of correct answers on a questionnaire of intensive care nurses' knowledge regarding the systemic inflammatory response syndrome (n=45)

QUESTIONNAIRE		CORRECT ANSWERs	PERCENTAGE ANSWERING CORRECTLY		
			PRE	IMMEDIATE	POST
1	What is sepsis?	A body toxic response to an infection.	42.2%	84.4%	62.2%
2	Sepsis can be developed from....., which one of the following?	A urinary tract infection (UTI)	80.0%	88.9%	93.3%
3	How many systemic inflammatory response syndrome criteria must a patient exhibit to to be considered to have severe inflammatory response syndrome?	Two or more	51.1%	97.8%	84.4%
4	Which of the following is a common symptom of systemic inflammatory response syndrome?	Fever	64.4%	84.4%	66.7%
5	Which assessment causes would increase the patient's risk of having systemic inflammatory response syndrome?	15 pack-year smoking history	71.1%	88.9%	77.8%
6	A patient who is still having hypotension after initial fluid resuscitation has which form of sepsis?	Septic shock	22.2%	44.4%	57.8%
7	Which laboratory test can expect to be done to help confirm systemic inflammatory response syndrome?	Complete blood count	88.9%	100%	73.3%
8	A patient has developed Multiple Organ Dysfunction Syndrome (MODS). For which of the following classic coagulation system findings would the nurse monitor the patient?	Clots in microcirculation	40%	82.2%	60%
9	When someone has severe sepsis, their chances of survival drop by almost 8% for every _____ that goes by without treatment.	Hour	53.3%	91.1%	75.6%
10	What age group is most susceptible to sepsis?	Elderly	71.1%	97.8%	80%
11	Who is at the highest risk for developing sepsis?	People with cancer	68.9%	91.1%	64.4%
12	the mean arterial pressure (MAP) is considered the main indicator of systemic inflammatory response syndrome criteria if	> 70 mmHg	48.9%	86.7%	71.1%
13	kidneys dysfunction is a sign of severe sepsis if urine output	< 0.5 mL/kg/hr	48.9%	82.2%	71.1%
14	severe inflammatory response syndrome is characterized by glucose metabolism if blood glucose.....	> 140 mg/dl	51.1%	75.6%	66.7%
15	Glasgow Coma Scale (GCS) is an indicator of brain dysfunction in severe sepsis if is	< 13	84.4%	97.8%	77.8%
16	edema or positive fluid balance is an indicator of systemic inflammatory response syndrome if fluid	> 20 ml/kg over 24 hr	62.2%	88.9%	77.8%
17	A patient is in the intensive care unit with multiple organ dysfunction syndromes. Which assessment finding would indicate to the nurse that the patient is experiencing failure of the gastrointestinal system?	Absent bowel sounds	46.7%	95.6%	75.6%
18	..... increase the risk of sepsis?	Diabetes	71.1%	88.9%	80%
19	If lactate is high in a sick patient, what might be the cause?	Sepsis	55.6%	82.2%	62.2%
20	What are some non-infectious causes of SIRS?	Trauma, Burns, and pancreatitis	60%	88.9%	84.4%

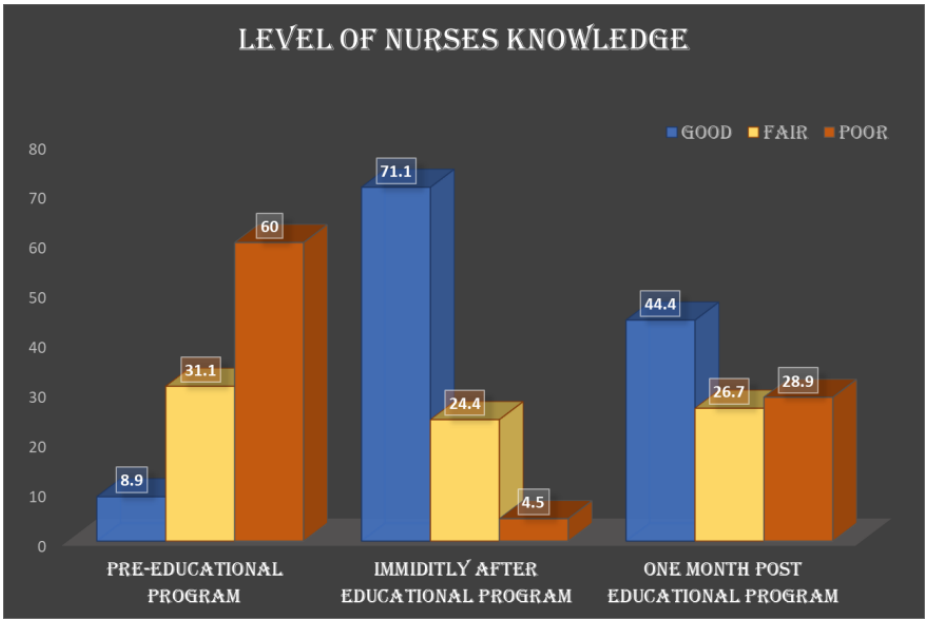

Figure 2: Distribution of the studied nurses regarding their level of knowledge pre, immediate, and post-implementation of educational program (n=45)

Figure 2 it shows that only 8.9% of studied nurses had good knowledge regarding SIRS before receiving the program, and 31.1% had fair knowledge, with a high percentage of poor knowledge at 60%. While immediately post-program, their level of knowledge improved, with 71.1% having good knowledge and fair and poor knowledge decreasing to (24.4%, and 4.5%), respectively. But after one month of follow-up, a slight decline in the level of good knowledge was observed at 44.4%, while an increase in fair knowledge was observed at 26.7%, and poor knowledge at 28.9%.

Table 3 it illustrated the relationship between nurses' knowledge and their sociodemographic characteristics. It noted that there was no statistically significant relationship between the total knowledge of studied nurses and their age, sex, nationality, educational level, and years of experience before and after educational program implementation. The good level of knowledge increased immediately after the educational program and then slightly decreased after one month, except in age (40-49 years) It showed an increase after one month of an educational program, while inexperience (> 11 years of experience in ICU) it remained the same with no change immediately and after one month of an educational program.

Table 3: Relation between nurses' knowledge and their socio-demographic characteristics (n=45)

socio-demographic characteristics	Nurses' knowledge level								
	PRE-EDUCATIONAL PROGRAM			IMMEDIATELY AFTER THE EDUCATIONAL PROGRAM			ONE MONTH AFTER THE EDUCATIONAL PROGRAM		
	GOOD N %	FAIR N %	POOR N %	GOOD N %	FAIR N %	POOR N %	GOOD N %	FAIR N %	POOR N %
AGE									
≤20- 29 years	0 (0%)	6 (13.3%)	11 (24.5%)	11(24.5%)	5(11.1%)	1 (2.2%)	5(11.1%)	5(11.1%)	7 (15.6%)
30- 39 years	2 (4.4%)	3 (6.7%)	12 (26.7%)	12(26.7%)	5(11.1%)	0 (0%)	5(11.1%)	7(15.6%)	5 (11.1%)
40- 49 years	2 (4.4%)	5 (11.1%)	4 (8.9%)	9 (20%)	1 (2.2%)	1 (2.2%)	10(22.2%)	0 (0%)	1 (2.2%)
P value	0.000			0.113			0.045		
SEX									
Female	4 (8.9%)	14 (31.1%)	25 (55.6%)	30(66.7%)	11(24.5%)	2 (4.4%)	19(42.2%)	12(26.7%)	12(26.7%)
Male	0 (0%)	0 (0%)	2 (4.4%)	2 (4.4%)	0 (0%)	0 (0%)	1 (2.2%)	0 (0%)	1 (2.2%)
P value	0.000			0.453			0.121		
NATIONALITY									
Saudi	0 (0%)	4 (8.9%)	11 (24.5%)	10(22.2%)	4 (8.9%)	1 (2.2%)	6 (13.3%)	5(11.1%)	4 (8.9%)
non-Saudi	4	10	16	22 (49%)	7 (15.5%)	1	14(31.1%)	7 (15.6%)	9 (20%)

	(8.9%)	(22.2%)	(35.5%)			(2.2%)			
P value	0.191			0.023			0.110		
QUALIFICATION									
Diploma	2 (4.4%)	3 (6.7%)	4 (8.9%)	6 (13.4%)	2 (4.4%)	1 (2.2%)	7 (15.6%)	2 (4.4%)	0 (0%)
Bachelor	2 (4.4%)	11 (24.5%)	23 (51.1%)	26(57.8%)	9 (20%)	1 (2.2%)	13(28.9%)	10(22.2%)	13(28.9%)
P value	0.129			0.023			0.194		
MARITAL STATUS									
Single	1 (2.2%)	6 (13.3%)	12 (26.7%)	13 (29%)	6 (13.3%)	0 (0%)	7 (15.6%)	5 (11.1%)	7 (15.6%)
Married	3(6.7%)	7 (15.6%)	15 (33.3%)	18 (40%)	5 (11.1%)	2 (4.4%)	12(26.6%)	7 (15.6%)	6 (13.3%)
Divorced	0 (0%)	1 (2.2%)	0 (0%)	1 (2.2%)	0 (0%)	0 (0%)	1 (2.2%)	0 (0%)	0 (0%)
P value	0.000			0.000			0.020		
YEARS OF EXPERIENCE IN ICU									
≤1 year.	0 (0%)	1 (2.2%)	1 (2.2%)	2 (4.4%)	0 (0%)	0 (0%)	1 (2.2%)	1 (2.2%)	0 (0%)
1-5 years	2 (4.4%)	6 (13.3%)	15 (33.5%)	15(33.3%)	7 (15.6%)	1 (2.2%)	7 (15.6%)	6 (13.4%)	10(22.2%)
6-10 years	0 (0%)	2 (4.4%)	4 (8.9%)	3 (6.7%)	3 (6.7%)	0 (0%)	0 (0%)	4 (8.9%)	2 (4.4%)
≥11 years	2 (4.4%)	5 (11.1%)	7 (15.6%)	12(26.7%)	1 (2.2%)	1 (2.2%)	12(26.7%)	1 (2.2%)	1 (2.2%)
P value	0.032			0.204			0.112		

DISCUSSION

Critical care nurses play a major role in providing nursing care for critically ill patients and require specific training. The current study aimed To Evaluate the Effectiveness before, immediately, and one month after the implementation Educational Program on Intensive Care Unit Nurses' Knowledge Regarding Systemic Inflammatory Response Syndrome at King Khalid General Hospital in Hafr Albatin. The study hypothesized that the post mean score of nurses' knowledge regarding SIRS criteria after implementing an educational program would be higher than their score before implementation. There were significant improvements in the knowledge of studied nurses after education.

Regarding socio-demographic characteristics, the results of the current study showed that three-quarters of studied nurses aged from twenty-five to less than forty years old, with a mean age of 34.91± 8.32 years. From the researcher's perspective, this may be because most nurses being recently graduated and most young nurses can deliver direct care in the ICU for patients effectively, while the older age groups of nurses have administrative roles. This result is congruent with El-gendy *et al*., (2022) in their study titled " Effect of An Educational Program on Nurses' Performance regarding Prevention of Venous Thromboembolism among Critically Ill Patients" Whose results revealed that the majority of the studied nurses' were in the age group between twenty and thirty years old. It is incongruent with Sheta & Tantaewy, (2022) in their study titled " Effect of Evidence-Based Program on Critical Care Nurses' Performance Related to Care for Intubated Patients" which emphasized the majority of their studied nurses' age was from twenty to less than thirty years old.

As regards the gender of the studied nurse figure (1), shows that more than two-thirds of the nurse's sample were females. It may be because of the old perspective that nursing is a special profession for females. This result is compatible with Aboushady *et al*., (2022), El-gendy *et al*., (2022) & Sheta & Tantaewy, (2022) stated that the majority of the nurses' studied were females. On the other hand, this result disagreed with Bakey, (2018) in a study titled "Evaluation of Nurses' Practices throughout Hemodialysis Treatment for Patients in hemodialysis unit at Baghdad teaching hospitals" who stated that more than half (53.3%) of studied nurses were males. And also disagreed with Kassew *et al.*, (2020) in their study entitled "Nurses' Knowledge, Attitude, and Influencing Factors regarding Physical Restraint Use in the Intensive Care Unit: A Multicenter Cross-Sectional Study" which emphasized the majority of their studied nurses' gender were male.

Concerning nurses' nationality according to the table (1), one-third of the studied nurse were Saudi while the remaining are non-Saudi. From the researcher's point of view, this may be due to most Saudi nurses being recently employed in critical areas. These results were in the same line with Almutairi *et al*., (2022) in their study titled "Managing patients' pain in the intensive care units Nurses' awareness of pain management" stated that less than one-quarter of nurses working in intensive care were from Saudi nationality.

As regards the educational level, The results of the current study showed that four-fifths of the studied nurses had bachelor's degrees while the remaining had diploma degrees. These findings were matched with Sankar *et al*., (2022) who study " Effectiveness of Developmentally Supportive Education Program on Nursing Knowledge of Retinopathy of Prematurity in Neonatal Intensive Care Unit" and indicated that the majority of studied nurses were bachelor's degrees. But, This study was contradicted by Khalil *et al*., (2022) whose study "Effect of Evidence-Based Guidelines on Nurses' Performance to Reduce Complications for Patients after Bone Marrow Transplantation" reported that the highest percentage of studied nurses had nursing diplomas. Moreover, this result disagrees with Elmarakby *et al*., (2022) with their study " Effect of an Educational Program on Maternity Nurses' Knowledge and Attitude About Umbilical Cord Blood Banking and its Barriers" who find that half of the studied nurses had a nursing diploma degree.

Regarding Marital Status, the finding of the current study showed that more than half of thestudied nurses were married. This finding was consistent with Alramadhan *et al*., (2019) with their study " Assessment of the Nurses' Knowledge during Caring for Hemodialysis Patients "who reported that more than half of the sample nurses were married. But this result was contradicted by Obaid in their study " Nurses' Knowledge Concerning Neonatal Sepsis In Neonatal Intensive Care Units At Pediatric Teaching Hospitals In Baghdad City" who found the single studied nurses were more than married.

Concerning years of experience, the findings of the current study showed that half of the studied nurses had from 1–to 5 years of experience in ICU. From a researcher's point of view, it may be due to the nature of the intensive care unit that it is an area of specialty that requires a young, qualified nurse to offer a better quality of nursing care and be able to tolerate the workload as patients require complex assessment and continuous nursing vigilance. This finding is supported by Ali *et al*., (2022) their study titled" Effect of an Educational Program on the Nurses' Performance and Health Outcomes for Patients with Traumatic Head Injury "who revealed that more than half of the nurse's experiences varied between (1 – 5 years) of experience. This result disagreed with El-gendy et al., (2022) who stated that half of the sample nurses had experienced between 5- 10 years.

By looking at the previous educational program, Concerning using SIRS criteria in the hospital, the result has shown that most nurses consensus that they have not used this criterion in their hospital before except for two nurses. it may be because they are new, or they did not understand the question well.

Regarding attending training programs, the present study found that most of the studied nurses did not attend any courses regarding SIRS criteria before. This finding is supported by El Sayed & Ahmed, (2017) who showed that in their study none of the nurses had any previous training related to sepsis or SIRS.

By looking at the level of nurses' knowledge, it illustrated that there was a knowledge deficit regarding Systemic Inflammatory Response Syndrome among intensive care nurses. This result shows a highly statistically significant increase in the mean score of nurses' knowledge level before and immediately after the educational program. This finding has been strengthened and enhanced by Mahmoud *et al*., (2022) who studied " Effect of the Educational Package based on Health Belief Model on Nursing Students' Knowledge and Attitude Regarding Human Papillomavirus and Cervical Cancer" illustrated that there was an increase in knowledge after an educational program

Finally, the current study has proven the hypothesis that the Nurses' knowledge level regarding Systemic Inflammatory Response Syndrome significantly improved after implementing an educational program than their level before.

CONCLUSIONS

The present study concluded that the implementation of an educational program had been significantly effective in improving nurses' knowledge regarding Systemic Inflammatory Response Syndrome as illustrated by total mean scores of knowledge level immediately post and after one month of follow-up of the program implementation, which was higher than pre-program.

RECOMMENDATION

- Conducting continuous educational programs in regular for intensive care nurses regarding systemic inflammatory response syndrome to help identify early detection of sepsis
- Repetition of the study on a larger sample include nurses and physicians from different departments to generalize the results.
- The administration allows the implementation of a score for systemic inflammatory response syndrome clinically in the intensive care unit. Furthermore, studies are being conducted to incorporate the systemic inflammatory response syndrome score into the routine assessment of intensive care units in the early detection of sepsis.

ACKNOWLEDGMENTS

I would like to extend my appreciation to the University of Hafr Batin-Al for its commitment to nursing education on this journey. Especially Dr.

Najwa, for her guidance and ability to ease my mind throughout this process, and Dr. Jalal, for his insight, leadership, and advocacy for nurse practitioners.

I would also like to express my thanks to the authorities of the directorate of health affairs in Hafer albaten, King Khalid general hospital, and intensive care unit nurses for providing the necessary facilities for conducting the study.

ABBREVIATIONS

SIRS = Systemic Inflammatory Response Syndrome.
MOF = Multiple organ failure.
NEWS = National Early Warning Score.
MEWS = Modified Early Warning Score.
MEDS = Mortality in Emergency Department Sepsis score.
SOS = Search Out Severity score.
qSOFA = Quick Sequential Organ Failure Assessment.
ED = emergency department.
ICU = intensive care unit.
WHO= World Health Organization

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