

Effect of Sepsis Educational Bundle on Nursing Management and Patients' Outcomes in Intensive Care Units

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ABSTRACT

Background: Sepsis is a common clinical condition associated with a high mortality rate among hospitalized patients and one of the main causes of death worldwide. Nurses caring for critically ill patients must possess comprehensive knowledge of sepsis to ensure early recognition and effective prevention. **The aim of the study** was to evaluate the effect of sepsis educational bundle on nursing management and patients' outcomes in intensive care units. **Research design:** was a quasi-experimental design with pre-test and post-test, **Setting;** the study was conducted at ICU of New Surgery Hospital and Emergency Hospital at Zagazig university hospitals. **Subjects;** the study sample included 40 nurses and 40 adult patients from the ICU of Zagazig University Hospitals. **Three tools were used: Tool 1:** an Interviewing Questionnaire to assess nurses' demographics and nurses' knowledge on sepsis, **Tool 2:** Observational Checklist to evaluate nurses' practices in sepsis care, and **Tool 3:** Patients' Assessment Questionnaire to assess patient demographics and outcomes related to sepsis. **Results;** The study demonstrated significant improvements after the educational bundles, where satisfactory knowledge levels increased from 10.0% to 92.5% ($p = 0.001$), and satisfactory practice levels rose from 10.0% to 92.5% ($p = 0.001$). ICU stay decreased from 9.5 ± 3.74 to 8.3 ± 3.87 days, while mortality declined from 42.5% to 22.5%. Moreover, nurses' knowledge ($r = -0.606$, $p = 0.001$) and practice ($r = -0.576$, $p = 0.001$) showed strong negative correlations with patient outcome in the post-intervention phase. **Conclusion;** The educational bundles for sepsis significantly enhanced nurses' knowledge and clinical practices, leading to improved patient outcomes. **Recommendations;** Generalize and implement the sepsis educational bundle regularly in all intensive care units, with periodic updates based on the latest clinical guidelines and evidence-based practices.

Keywords: Educational bundles, Sepsis, Nursing management and Clinical Outcome

INTRODUCTION

Sepsis, a life-threatening condition caused by a dysregulated host response to infection, remains a major global health challenge, particularly in low- and middle-income countries (Rudd et al, 2020). According to the World Health Organization, (2024), sepsis affects about 49 million people annually and causes around 11 million deaths—nearly 20% of global mortality. For every 1000 hospitalized patients, an estimated 15 patients will develop sepsis as a complication of receiving health care.

Sepsis can arise from both community-acquired and hospital-acquired infections. From these infections, pneumonia represent the most common source next most common sources are intraabdominal and genitourinary infections. (Brant et al., 2022).

Fauci et al., (2022). The earlier presentation of sepsis, patients present with the following vital sign changes: Fever, or

hypothermia, Tachycardia and Tachypnea

Sepsis-1 bundles are tasks to be completed within 3 hours and 6 hours of suspicion/recognition of sepsis. These specifically are: 3 Hour Bundle: measure lactate, draw blood cultures, start appropriate antimicrobial therapy, give fluid resuscitation (30 mL/kg) for hypotension or lactate >4, start pressors if hypotension is profound during or persistent after the fluid resuscitation. While 6 Hour Bundle: Repeat lactate if initial lactate >2, Repeat volume status and tissue perfusion assessment after fluid resuscitation, titrate vasopressors to goal MAP>65mmHg (Jessie, 2023).

Nurses play a central role in the early detection and management of sepsis across healthcare settings. In emergency departments, triage nurses are often the first to identify community-acquired sepsis, while in hospital wards, bedside monitoring enables early recognition of hospital-onset cases. Evidence shows that nurse-led sepsis screening interventions reduce mortality and enhance adherence to sepsis care bundles. (Chua et al., 2023).

Key responsibilities of nurses include frequent assessment of vital signs, neurological status, oxygenation, ventilation, and fluid balance. Ensure timely cultures and laboratory investigations, early antibiotic administration, infection control measures, and preventive care such as DVT and pressure sore prophylaxis. Additional roles include nutritional support through dietitian consultation, patient and family education on septic shock, aspiration prevention, and close follow-up of culture results, antibiotic sensitivity, and imaging reports to guide ongoing management (Mahapatra, 2024).

Choy et al., 2022 stated that educational bundle is a structured set of evidence-based learning interventions, resources, and strategies designed to improve knowledge, skills, and clinical practice on a specific topic to improve learners' long-term outcomes. In addition, sepsis education and a protocol-based sepsis care bundle act in synergy to augment greater improvements in care processes and patient benefits.

Significance of the study

Sepsis is a global health issue associated with increased morbidity and mortality worldwide. According to Madkour et al., (2022) in study conducted in the Abasia Chest Hospital, Cairo, Egypt reported that prevalence of sepsis in respiratory ICU was 26.5% and it is usually associated with higher mortality rate in those patients. Furthermore, Mansour et al., (2022) found that 23% of patients admitted to surgical intensive care unit, Zagazig university hospitals had sepsis and 16% of readmission because of sepsis. Rababa et al., (2022) stated that raising awareness about sepsis positively impacted nurses' knowledge, attitudes, and practice related to caring for patients with sepsis. So that the implementation of sepsis educational bundles about early identification and fast response by nurses at the initial points of care can improve the patient outcome, reducing the patient deterioration. So that, the study aims to evaluate the effect of sepsis educational bundle on nursing management and patients' outcomes in intensive care units.

Aim of the Study

This study aimed to evaluate the effect of sepsis educational bundle on nursing management and patients' outcomes in intensive care units.

This aim will be fulfilled through the following objectives:

1. Assess nurse's knowledge and practices regarding nursing management for sepsis in intensive care units.
2. Design educational bundles of sepsis for prevention, early recognition and management of patients with sepsis.
3. Implement educational bundles of sepsis for prevention, early recognition and management of patients with sepsis.
4. Assess the effect of nurse's knowledge and practices a post educational bundle on patient outcome.

Research hypothesis

This study will have two research hypotheses including:

H1: Nurse's knowledge will be improved after implementing educational bundle of sepsis.

H2: Nurse's practices will be improved after implementing educational bundle of sepsis.

H3 The educational bundles on nursing management for patients with sepsis will have positive effect on the patient outcome.

Research design; A quasi-experimental design with pre- and post-test. **Setting;** The present study was conducted at ICU of New

Surgery Hospital and Emergency Hospital at Zagazig university hospitals. **Subject; For nurses;** Purposive sample of (40) nurses working in previously mentioned setting with **inclusion criteria;** Nurses with at least one year of experienced at ICU. While, **for patients;** Purposive sample of (40) patients who admitted to ICU, adult patients with age ≥ 18 years. With **exclusion Criteria:** All pediatric patients, pregnant women and patient with sepsis and having end stage organ dysfunction such as end stage renal disease, liver cell failure, immune compromised patients, end stage cancer and acute brain and heart attack.

Tools for data collection:

The following tools was used to collect data in this study. They were designed by the researcher after extensive review of the updated and relevant literature (Ejlal et al., 2022, Nakiganda et al., 2022 & Zanaty et al., 2016)

Tool I: An Interviewing Questionnaire:.. It includes two parts as the following:

Part 1: Sociodemographic Characteristics for Nurses:

Part 2: It was included tool of (29) questions and concerned with **The Nurses' Knowledge** regarding sepsis identification and sepsis management. This questionnaire was developed by researcher after reviewing the updated and relevant literature (Salameh & Aboamash, 2022).

Scoring system for Nurses' interviewing questionnaire

Each question was scored "zero" for the incorrect or unanswered question and "one" for the correct answer, and these points were counted for each nurse. The general nurses' knowledge was classified into satisfactory knowledge if the score $\geq 80\%$ from the maximum score and unsatisfactory knowledge if it $< 80\%$ based in statistical analysis.

Tool II; An Observational Checklist: It was contained two parts

Part I; observational checklist used to assess general nurse's practices regarding care for patient with sepsis. This tool published and validated by Lino et al., (2019) and adopted by researcher.

Part II; observational checklist used to assess nurses practices for administering oxygen by mask, administering oxygen by nasal cannula, suctioning an endotracheal tube: open system, assist in central venous insertion and peripheral line insertion (Lynn, 2022, Dambaugh, 2019. and Malyaman, 2019).

Scoring System for Observational Checklist

Each step was scored "zero" for not done and "one" for done in the correct way; and not applicable items was excluded then these points are counted for each nurse. The general nurses' practice is classified into satisfactory practice if the score is $\geq 80\%$ and unsatisfactory practice if it is $< 80\%$ based in statistical analysis.

Tool III; Patients Assessment Questionnaire:

It had three parts as the following:

Part 1: It was concerned with **Sociodemographic characteristics of patients**

Part 2: It was concerned with the **Patients' Past and Current Medical and Surgical History**

Part 3: It was concerned with outcomes of patients with sepsis as vital signs values, GCS score, length of hospital stay, complications associated with sepsis, prognosis of the patient and lab investigations (including Serum lactate, Procalcitonin, Total leukocytic count, C-reactive protein; that was assessed at three times upon admission, post 3rd day and post 7th day). (Khalil et al., 2022)

Administrative Design and ethical consideration;

To carry out this study, the necessary approvals were obtained from dean of the faculty of nursing and submitted to general director of Zagazig university Hospitals, then permission to carry out the study was obtained from the managers of Emergency and New Surgery hospitals after explaining the purpose of the study and a verbal consent was obtained from nurses' and patients for participation in the study.

Before the initial interview, each potential subject was informed about the nature, purpose, benefits of the study, and informed that his/her participation is voluntary. Confidentiality and anonymity of the subjects were also assured through coding of all data. The researcher assured that the data collected, and information will be confidential and would be used only to improve their knowledge and practice and for the purpose of the study. There was no risk in study subject during application of the research.

Pilot study

A pilot study for data collection was carried out in order to test whether the tools are clear, understandable, feasible, applicable, and time consuming. Ten percent from the total sample size that equal four nurses' and four patients were selected randomly from intensive care units to participate in testing of the tools; these four nurses and patients were selected outside the original study sample which consisted of 40 nurses and 40 patients.

Field work

The study was implemented from beginning of January 2024 to end of December 2024 where the researcher was available two days weekly (Sunday and Thursday) during afternoon shift from 12 pm to 5 pm.

1. Regarding the implementation of educational bundles for sepsis for nurses including four phases;

- **Assessment phase:** This phase aimed to assess nurses' knowledge and practices regarding sepsis bundles of care (early recognition and proper nursing management). It was conducted through one session (pretest). The information obtained served as baseline data, and guided the researcher in the preparation of the educational program.
- **Planning phase:** Using the assessment data and related literature, (Giddens, 2023, Urden et al., 2022, Aitken et al., 2021 and Harding et al., 2020) the researcher developed educational bundle to train nurses' and improve their knowledge and practice about sepsis bundles of care. The educational bundle included a theoretical and a practical part. The researchers prepared an illustrated guideline booklet in Arabic language to help nurses' review and refresh the information provided to achieve aim of the study.
- **Implementation phase:**
 - **The theoretical part** was implemented through (3) sessions through lecture and group discussion about definition of sepsis, risk factors, causes, pathophysiology, diagnosis, screening, complications, sepsis bundles of care, nursing care, and prevention of sepsis.

The practical part was implemented through (8) sessions through demonstration and redemonstration of the following procedures as: Physical assessment of patients with sepsis, Intravenous fluid, how to calculate fluid balance and how to administer IV fluid, Care for mechanically ventilated patients, Assist in insertion of central venous catheter, Routine care for central venous catheter, Collecting blood and urine culture, Care for surgical wound, and Safety precaution for patient with sepsis (Fall precaution, Deep venous thrombus prophylaxis and Bed sores prophylaxis).

- **Evaluation phase:** Each nurse in the study was evaluated two times using the same data collection tools. This was done upon recruitment (pretest) and after 3 months of education bundles as post-test.

2. Regarding patient outcome evaluation;

Researcher interview the patient to explain purpose of the study and obtaining verbal consent to participate, then patient interview implemented to assess demographics of them and review of medical file to assess medical history, present illness and patient outcome. The interview performed during implementation of the program then reassess after implementation of the educational bundles in synchronization with pre and post test.

The pre and post patients groups are different in both groups because the patients involved in the preintervention phase were no longer hospitalized at the time of post-intervention data collection, either due to discharge or death. Therefore, a new patient group was selected six months later. resulting in two distinct patient samples.

Content validity

The tools were reviewed by a panel of one professors and four assistant professors in medical surgical nursing, faculty of nursing, Zagazig University to ensure their content validity. The tools were also reviewed for clarity, relevance, comprehensiveness, applicability, and understanding. According to the expertise's modifications and the results of the pilot study, some modifications were applied in the form of rephrasing or rewording accordingly.

Tools reliability

Nurses' knowledge practice and patient outcome were tested for reliability and showed high reliability through measuring its alpha Cronbach coefficient; (knowledge was 0.787, General practice regarding care bundles was 0.795, Administering Oxygen by Mask was 0.786, Administering Oxygen by Nasal Cannula was 0.784, Suctioning an Endotracheal Tube was

0.721, Central venous catheter was 0.714, Peripheral venous catheter was 0.733, and Patient Outcome was 0.785) indicating high reliability.

Statistical Design

All data were collected, tabulated and statistically analyzed using IBM SPSS for windows (Version 25; IBM Corp., Armonk, NY, USA, 2017). Quantitative data were expressed as the mean $\pm$ SD and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Mc nemar test was used to compare between two dependent groups of categorical data. paired t-test was used to compare between two dependent groups of normally distributed variables. Percent of categorical variables were compared using Chi-square test or Fisher's exact test when appropriate.

ANOVA (One way analysis of variance) test was used for comparison between more than two different groups of quantitative data which were normally distributed. The student "t" test was used for comparison of means of two independent groups of quantitative data which were normally distributed. Pearson correlation coefficient was calculated to assess relationship between study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation.

Multiple linear regression (step-wise) was also used to predict factors which affect knowledge and practice scores. Cronbach alpha coefficient was calculated to assess the reliability of the scales through their internal consistency. P-value < 0.05 was considered statistically significant, p-value < 0.01 was considered highly statistically significant, and p-value $\geq$ 0.05 was considered statistically non-significant.

Results;

Regarding the age (92.5%) of the studied nurses were aged between 20 and 30 years, with a mean age of 27.75 ± 2.25 years. regarding the education (62.5%) graduated from a nursing technical institute, while (37.5%) held a bachelor's degree. In terms of experience, (65%) had between 5 to 10 years of experience, with a mean of 6.15 ± 2.02 years. And (10%) had received formal training on sepsis bundles (**Table 1**).

Regarding to Total knowledge score of studied nurses the current study revealed that Before the educational bundles, (87.5%) of studied nurses had unsatisfactory knowledge. While post-educational bundles, (75.0%) achieving a satisfactory level with p-value (0.001). As regards to total practice score 10.0% of studied nurses demonstrated satisfactory practice levels before the educational bundles, that increased to 92.5%.Post-educational bundles ($p = 0.001$) (**Figure 1**)

Regarding to Nurses' practices; The educational bundles resulted in significant improvements across most clinical practice domains. Compliance with care bundles increased from 2.5% to 60.0%, while oxygen administration via mask and nasal cannula rose from 20.0% to 70.0% and 57.5%, respectively ($p = 0.001$ for all). Suctioning endotracheal tubes showed the greatest improvement (12.5% to 87.5%), and adherence to central venous catheter care increased from 55.0% to 97.5%. Overall practices score improved from 10.0% to 92.5% ($p = 0.001$) (**Table 2**).

Regarding demographics of studied patient the current study revealed that (50%) of pre-educational bundles' studied patients group were aged more than 60 years, with a mean age of 61.00 ± 10.13 years, and (57.5%) were males. While (42.5%) of post-educational bundles studied patients aged over 60 years, with a mean age of 60.34 ± 9.5 years. And (62.5%) were males (**Table 3**).

Table (4) shows that (52.5%) of studied patients diagnosed with septic shock pre educational bundle phase. While in the post-educational bundle phase, (60.0%) of studied patients diagnosed with septic shock. Regarding to the causes of sepsis, urinary tract infection represented the most frequent cause in both groups [(27.5%) in pre-education group and (22.5%) in post-education group]. Also, the majority of studied patients in both phases had chronic diseases (90% in pre and 95% in post). Where most of studied patients had diabetes (85% in pre and 80% in post).

Table (5) reveals that the mean ICU stay decreased from 9.5 ± 3.74 in pre educational bundles to 8.3 ± 3.87 days post educational bundles. Regarding to complication of sepsis; Acute respiratory distress syndrome decreased from (42.5%) to (27.5%), and altered glycemic control decreased from (22.5%) to (10%). Most importantly, the percentage of patients who fully recovered increased from (25%) to (42.5%), while death rate decreased from s (42.5%) to (22.5%) among studied patients in both phases of the study but this findings hadn't statistical significance.

Table (6) reveals an important correlations between nurses' total knowledge, total practice, and patient outcomes throughout the study phases. In the pre-educational bundle phase, neither nurses' knowledge ($r = -0.199$, $p = 0.218$) nor practice ($r = -0.111$, $p = 0.494$) showed a significant correlation with patient complications. However, In the post-education phase, both knowledge (**r

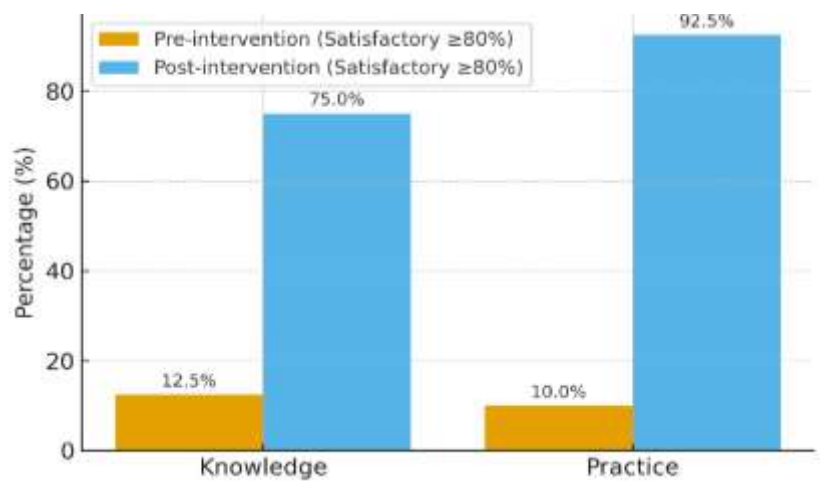
= -0.606, $p = 0.001^{**}$) and practice ($**r = -0.576$, $p = 0.001^{**}$) demonstrated strong, statistically significant negative correlations with patient outcome.

Table (1): Frequency and Percentage Distribution of Sociodemographic Characteristics for the Studied Nurses (n=40).

Characteristics	No.	%
Age		
20-30	37	92.5
>30	3	7.5
Mean± SD	27.75± 2.25	
Sex		
Male	20	50.0
Female	20	50.0
Education		
Diploma of nursing	0	0.0
Nursing technical institute	25	62.5
Bachelor degree	15	37.5
Years of experience		
≤5 years	14	35.0
5-10 years	26	65.0
Mean± SD	6.15±2.02	
Marital state.		
Married	36	90.0
Not married	4	10.0
Income		
Enough	12	30.0
Not enough	28	70.0
Formal training on sepsis bundles		
Yes	4	10.0
No	36	90.0

Figure (2): Pre- and Post-Intervention Satisfactory Levels of Nurses' Knowledge and Practice Regarding Sepsis (n=40).

Table (2) : Frequency and Percentage Distribution of Total Satisfactory Levels of Studied Nurses' Practice Domains Throughout Study Phases (n=40).



Pre-intervention	Post-intervention	MCp-value
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Domains	No.	%	No.	%	
General practice regarding care bundles	1	2.5	24	60.0	0.001**
Administering Oxygen by Mask	8	20.0	28	70.0	0.001**
Administering Oxygen by Nasal Cannula	8	20.0	23	57.5	0.001**
Suctioning an Endotracheal Tube	5	12.5	35	87.5	0.001**
Central venous catheter	22	55.0	39	97.5	0.001**
Peripheral venous catheter	39	97.5	40	100.0	0.982
Total	4	10.0	37	92.5	0.001**

MC: McNemar test, non-significant($p>0.05$), **: statistically highly significant ($p<0.01$)

Table (3): Frequency and Percentage Distribution of Sociodemographic Characteristics for The Studied Patients Throughout Study Phases (n=40).

Characteristics	Patients (pre-intervention)		Patients (Post-intervention)	
	No.	%	No.	%
Age				
40-<50	8	20.0	10	25.0
50-<60	12	30.0	13	32.5
>60	20	50.0	17	42.5
Mean± SD	61.00 ± 10.13		60.34±.5	
Gender				
Male	23	57.5	25	62.5
Female	17	42.5	15	37.5
Residence				
Rural	22	55.0	20	50.0
Urban	18	45.0	20	50.0
Social status				
Married	26	65.0	27	67.5
Not married	14	35.0	13	32.5
Educational level				
Educated	31	77.5	29	72.5
Not educated	9	22.5	11	27.5
Current work				
Not work	35	87.5	36	90.0
Work	5	12.5	4	10.0

Note; Studied patients in pre and post test were different

Table (4): Frequency and Percentage Distribution of the Studied Patients Regarding Current and Past Medical and Surgical History Throughout Study Phases (n=40).

History	Patients (pre-intervention)		Patients (Post-intervention)	
	No.	%	No.	%
Diagnosis				
Pneumonia	5	12.5	5	12.5
Diabetic foot	4	10.0	3	7.5
Gastritis	1	2.5	2	5.0
Septic shock	21	52.5	24	60.0
Sepsis	6	15.0	5	12.5
Others	4	10.0	4	10
Chief complain				
Chest pain	6	15.0	5	12.5

History	Patients (pre-intervention)		Patients (Post-intervention)	
	No.	%	No.	%
Fever	15	37.5	20	50.0
Disturbance conscious level	10	25.0	5	12.5
Diabetic foot	3	7.5	3	7.5
Dysuria	6	15.0	7	17.5
The cause of sepsis				
Pneumonia	13	32.5	12	30.0
Chest infection	3	7.5	3	7.5
Central line associated infection	2	5.0	3	7.5
Urinary tract infection	11	27.5	9	22.5
Diabetic foot	6	15.0	8	20.0
Others	8	20.0	8	20.0
Previous hospital admission				
No	10	25.0	12	30.0
Yes	30	75.0	28	70.0
Chronic medical condition				
No	2	5.0	4	10.0
Yes	38	95.0	36	90.0
If yes, what is it*				
Respiratory diseases	6	15.0	7	17.5
Diabetes	34	85.0	32	80.0
Liver diseases	5	12.5	4	10.0
Cardiovascular disorders	30	75.0	19	47.5
Others	6	15	19	47.5

Table (5): Frequency and Percentage Distribution of the studied patients regarding Outcome throughout study phases (n=40).

Patients' Outcome	Patients (pre-intervention)		Patients (Post-intervention)		FET	p-value
	No.	%	No.	%		
Length of stay due to sepsis (days) in ICU						
<10	28	70.0	25	62.5	FET	0.637
>10	12	30.0	15	37.5		
Mean±	9.50±3.74		8.30±3.87			
Complications due to sepsis						
ARDS	17	42.5	11	27.5	FET	0.241
Hypotension	40	100.0	38	95.0	FET	0.494
Septic shock	21	52.5	24	60.0	FET	0.494
Hydrostatic edema	8	20.0	4	10.0	FET	0.348
Coma or delirium	24	60.0	23	57.5	FET	0.999
Altered glycemic control	9	22.5	4	10.0	FET	0.225
Ileus	2	5.0	0	0.0	FET	0.494
Thrombocytopenia	1	2.5	1	2.5	FET	0.999
Mechanical ventilation due to sepsis						
No	14	35.0	18	45.0	FET	0.494
Yes	26	65.0	22	55.0		
Need of Vasoactive drugs due to sepsis						
No	2	5.0	3	7.5	FET	0.999
Yes	38	95.0	37	92.5		
Patient prognosis						
Complete improvement	10	25.0	17	42.5	χ 2 =4.313	0.116
Partial improvement	13	32.5	14	35.0		
Death	17	42.5	9	22.5		

FET: Fisher's Exact Test, χ^2 : Chi square test , non-significant($p > 0.05$), #: not mutually exclusive.

Table (6): Correlation between Total Knowledge and Total Practice of Studied Nurses and Complication of Patients Throughout Study Phases.

Pre	Patient outcome		Post	Patient outcome	
	r	p		r	p
Knowledge	-0.199	0.218	Knowledge	-0.606	0.001**
Practice	-0.111	0.494	Practice	-0.576	0.001**

Non significant($p>0.05$), *: significant($p<0.05$), r: correlation coefficient

Discussion;

Regarding studied nurses knowledge about sepsis, the current study found that before the educational bundles; the majority of studied nurses had unsatisfactory knowledge. But, post-educational bundles, there was a notable increases, with three quarters achieving a satisfactory level. This finding aligned with a study of **Regina et al., (2023)**, which identified significant deficiencies in sepsis awareness among studied nurses. Furthermore, a quasi-experimental study was conducted in the Heevi Pediatric and Maternity Hospitals revealed that, there was a notable enhancement, with scores improving from (11–17) before the intervention to (19–24) afterward (**Mohamed & Alatroshi 2022**).

The current study revealed that there was positive statistical significant relation between nurses knowledge before and after implementation of educational bundles. This finding consistent with a study conducted in Intensive care unit in jazan hospitals found that there was highly statistically significant difference between (pre-test, immediately and post-test) as regard overall knowledge (**Ayoub et al., 2022**).

Current study revealed that there was statistical different increase in nurses competencies regarding general practices of sepsis care; that increased from 2.5% of studied nurses had good practices trust increased to 60% post educational bundles implementation with P value 0.001. this study aligned with study conducted at intensive care unit at Fayoum university hospital revealed that less than half of studied nurses were competent in care for patients with sepsis. (**Elsayed et al., 2023**).

Regarding history of chronic diseases, the current study revealed that majority of studied patients had diabetes, half of pre intervention group of patients had hypertension while one quarter of post intervention group had hypertension, and nearly one fifth of studied in both groups patients had heart diseases. This finding aligned with **Mostafa El-Malah et al, (2024)** in a study conducted at Emergency ICU at Zagazig University Hospitals revealed that more than half of studied patients had diabetes and hypertension while one tenth of them had respiratory problems.

On the other hand in a study conducted at the academic hospitals in Sweden, Switzerland, the Netherlands, and Germany revealed that cancer was the most prevalent condition, affecting nearly one-third of the patient with sepsis (32%), followed by diabetes mellitus and cardiovascular disease, each present one-fifth of patients (21%). Chronic pulmonary disease and renal disease were observed in 9% and 10% of patients (**Mellhammar et al., 2022**).

Regarding to the diagnosis, the current study revealed that more than half of studied patient in pre and post education had septic shock (52% and 60%), respectively. this finding was consistent with **Osman, et al. (2025)** in a study conducted at the Intensive Care Unit of the Internal Medicine Department at Zagazig University Hospitals revealed that about half of studied patients had septic shock with large proportion in non survivor group.

Regarding to length of ICU stay, the current study found that Mean of ICU length of stay before intervention was 9.50 ± 3.74 and after intervention was 8.30 ± 3.87 . also, patient mortality, the current study revealed that mortality rate was two-fifths of studied patient before education bundle but this percentage declined to one-quarter after educational bundle, but there was no statistical significance. This finding aligned with **Li et al. (2022)** conducted a study across ICUs in 22 Asian countries/regions and reported that the median ICU length of stay (LOS) for patients with sepsis was 12 days, while the median hospital LOS was 21 days. The ICU mortality rate was 32.7%, and the hospital mortality rate was 41.7%. Notably, a delay in antibiotic administration beyond three hours from the time of sepsis diagnosis was associated with increased mortality.

Furthermore, **Schinkel et al. (2022)** Found in a study conducted at the ED of the Amsterdam University Medical Centers, the Netherlands found that the intervention program did not significantly impact ED length of stay, hospital admission rates, ICU admission rates, or ICU length of stay.

Regarding to the mortality rate the current study reveals that two fifth of a studied patient dead before intervention but declined

to one fifth afterwards without statistical significance. This finding aligned with **Richardson et al. (2024)** reported, in a study was conducted at 371-bed hospital, that 30 days mortality rate before implementation of improvement initiative was one third declined to one fifth afterwards without statistical significance.

Regarding correlations between nurses' knowledge, practice, and patient outcomes, the current study revealed that in the post-educational bundles phase, both knowledge (** $r = -0.606$, $p = 0.001$ **) and practice (** $r = -0.576$, $p = 0.001$ **) demonstrated strong, statistically significant negative correlations with patient complications. This finding aligned with a study conducted at Intensive care unit in jazan hospitals, demonstrated a clear and statistically significant association between nurses' knowledge and adherence to the sepsis bundle and improved patient outcomes. Where the patients under the care of studied nurses experienced better clinical outcomes, including higher survival rates (36.7% vs. 23.3%) and reduced incidence of organ failure (8.5 vs. 13.03) (**Ayoub et al., 2022**).

Conclusion;

Sepsis educational bundles had a significant positive impact on nurses' knowledge and practices toward management of patients with sepsis, which was reflected in improved patient outcomes, including shorter ICU stays, lower mortality rates, and reduced sepsis-related complications.

Recommendations;

Generalize and implement the sepsis educational bundle regularly in all intensive care units, with periodic updates based on the latest clinical guidelines and evidence-based practices. Conduct continuous and structured training programs for nurses focusing on early recognition of sepsis, application of management protocols, and comprehensive clinical assessment.

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