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Sepsis management bundle in prevention of multiorgan dysfunction syndrome: Effectiveness of competency-based training among ICU nurses in Gurugram, Haryana

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***Abstract*---Background:** Sepsis, a life-threatening organ dysfunction caused by a dysregulated host response to infection, poses significant ICU mortality risk. Early implementation of the Hour-1 Sepsis Bundle can reduce progression to Multiorgan Dysfunction Syndrome (MODS), yet nursing knowledge gaps and inconsistent application hinder outcomes. **Aim:** To evaluate the effectiveness of competency-based training (CBT) on ICU nurses' knowledge and skill competencies

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regarding sepsis bundle implementation to prevent MODS. **Methods:** A one-group pre-test post-test design recruited 60 ICU nurses via purposive sampling in a tertiary-care hospital, Gurugram. A validated knowledge questionnaire and skill checklist assessed competencies pre- and post-intervention. Training included lectures, demonstrations, and simulations. Paired *t*-tests and Chi-square tests analyzed data ($p < 0.05$ significance threshold). **Results:** Mean knowledge scores improved significantly from 10.32 ± 3.12 to 16.48 ± 2.14 ($t = 14.67$, $p < 0.0001$). The proportion rated "Highly Competent" rose from 13.95% to 17.82%. Prior sepsis training was significantly associated with higher baseline and post-training knowledge (x^2, $p = 0.0004$). No significant associations with age, gender, or religion, while ICU type influenced outcomes. **Conclusion:** CBT substantially enhanced ICU nurses' sepsis bundle competencies. Incorporation of CBT into continuing education and nursing policy is essential to standardize care and reduce sepsis-related mortality.

***Keywords*---**Effectiveness, Competency Based Training, Knowledge, Skill, Sepsis Management Bundle, Prevention, Multiorgan Dysfunction Syndrome, ICU Nurses.

Introduction

Sepsis is a major global health problem, responsible for approximately 11 million deaths—nearly 20% of global mortality annually—affecting individuals across all age groups (Rudd et al., 2020) [1]. In India, high sepsis burden is magnified by resource limitations and delayed interventions.

The Surviving Sepsis Campaign (SSC) promotes the Hour-1 Bundle: performing a timely serum lactate measurement, obtaining blood cultures before antibiotics, administering broad-spectrum antibiotics, providing fluid resuscitation, and initiating vasopressors when necessary [2]. The 2018 SSC update emphasized rapid, combined interventions within the first hour [3]. Despite this, compliance remains suboptimal, especially in ICUs, where nurses are pivotal in bundle execution [4].

Educational interventions, particularly those that are structured and competency-based, have demonstrated effectiveness in improving sepsis bundle adherence and outcomes. For example, evidence-based educational programs in ICUs significantly increased bundle compliance and reduced mortality (Pryor, 2016) [5]. Virtual, case-based curricula improved nurses' understanding and bundle adherence (Jonkto et al., 2023) [6], while blending mind mapping with in-situ simulation enhanced knowledge, non-technical skills, and bundle execution rates (Zhao et al., 2025) [7].

Despite these findings, data from India on the impact of structured competency-based training among ICU nurses remains scarce. This study fills that gap by evaluating CBT's efficacy in improving knowledge and skills related to sepsis bundle management and MODS prevention.

Objectives

1. To assess the pre-existing knowledge and skill on sepsis management bundle in prevention of multiorgan dysfunction syndrome among ICU nurses.
2. To assess the effectiveness of a competency based training on knowledge and skill sepsis management bundle in preventing multiorgan dysfunction syndrome among ICU nurses.
3. To compare the pre-test and post-test score regarding knowledge and skill on sepsis management bundle in prevention of multiorgan dysfunction syndrome among ICU nurses.
4. To determine the association of knowledge and skill score regarding sepsis management bundle in prevention of multiorgan dysfunction syndrome with their selected demographic variables.

Hypotheses

1. **H_0-** There will be no significant differences between the Mean pre test and post scores on competency based training regarding knowledge and skill on sepsis management bundle in preventions of multiorgan dysfunction syndrome among ICU nurses at selected hospital of Gurugram.
2. **H_1-** There will be significant differences between the mean pre test and post test scores on competency based training regarding knowledge and skill on sepsis management bundle in preventions of multiorgan dysfunction syndrome among ICU nurses at selected hospital of Gurugram.
3. **H_2-** There is a significant association of level of competency based training regarding knowledge and skill on sepsis management bundle in preventions of multiorgan dysfunction syndrome with their selected demographic variable at $p \leq 0.05$ level of significance.

Materials and Methods

Design and Setting
A pre-experimental, one-group pre-test post-test design was employed at a 1500-bed tertiary-care hospital in Gurugram, Haryana, India.

Participants
Sixty ICU nurses (diploma/degree holders with ≥6 months ICU experience) were recruited via purposive sampling. Exclusion criteria included nurses on leave during the study period or not assigned to ICU duties.

Tools
1. **Demographic Sheet**: Age, gender, qualification, ICU experience, prior sepsis exposure, prior training.
2. **Knowledge Questionnaire** (20 MCQs): Assessed sepsis understanding; scores: 0–7 (inadequate), 8–14 (moderate), 15–20 (adequate). Reliability: KR-20 = 0.82.
3. **Skill Checklist** (20 items): Covered early recognition, Hour-1 bundle implementation, and documentation. Scores: ≤13 (not competent), 14–15

(needs improvement), 16–17 (competent), 18–20 (highly competent). Inter-rater reliability = 0.88.

Intervention – Competency-Based Training
A structured 1-hour session covered:

- Lecture on sepsis pathophysiology, MODS, and the SSC Hour-1 bundle.
- Demonstrations and return-demonstrations of bundle tasks.
- Simulation scenarios emphasizing critical thinking and application.

Procedure
Following ethical approval and consent, baseline knowledge and skills were tested. CBT was conducted and post-testing occurred on Day 7. A pilot study with six nurses validated feasibility.

Data Analysis
SPSS v25 was used. Paired *t*-tests assessed pre-post changes; Chi-square tests evaluated demographic associations. Significance threshold: $p < 0.05$.

Ethical Considerations
Clearance from Institutional Ethics Committee and hospital administration was obtained. Anonymous participation, confidentiality, and voluntary informed consent were ensured.

Results

SECTION I: DEMOGRAPHIC PROFILE OF ICU NURSES (N=60)

Table -1: Frequency and percentage distribution according to demographic variables of ICU nurses

S.NO.	DEMOGRAHIC	CATEGORY	FREQUENCY	PERCNTAGE (%)
1	Age	20-25	42	70%
		25-30	18	30%
		30-35	0	0%
		35-40	0	0%
2	GENDER	Male	17	28.33%
		Female	43	71.67%
3	RELIGION	Hindu	51	85%
		Muslim	3	5%
		Sikh	5	8.33%
		Christian	1	1.67%
		Other	0	0%
4	Professional Qualification	GNM	21	35%
		Post B.Sc Nursing	2	3.33%
		B.Sc Nursing	37	61.67%
		MSC Nursing	0	0%
		0-6 month	0	0%

S.NO.	DEMOGRAHIC	CATEGORY	FREQUENCY	PERCNTAGE (%)
5	Year Of ICU Experience	6month-1year	25	41.67%
		1year-3year	32	53.33%
		3year-5year	3	5%
		> 5 year	0	0%
6	Type Of ICU Working	Neuro ICU	37	62%
		Cardiac ICU	15	25%
		Respiratory IU	8	13%
		Multispecialty ICU	0	0%
7	Previous Training On Sepsis Management Bundle	Yes	23	38.33%
		No	37	61.67%
8	Frequency Of Managing Sepsis Cases	0-2	20	33.33%
		2-4	27	45%
		4-6	4	6.67%
		> 6	9	15%

SECTION II: KNOWLEDGE SCORES BEFORE AND AFTER TRAINING

TABLE: 2- FREQUENCY AND PERCENTAGE DISTRIBUTION OF ICU NURSES BY PRE-POST TEST KNOWLEDGE SCORE LEVELS

Level of knowledge	Pre-test (f/ %)	Post-test (f/ %)
Inadequate (0–7)	20 (33.3%)	0 (0%)
Moderate (8–14)	30 (50%)	10 (16.7%)
Adequate (15–20)	10 (16.7%)	50 (83.3%)

Interpretation- The table shows ICU nurses' knowledge levels before and after training: inadequate (33.3%→0%), moderate (50%→16.7%), and adequate (16.7%→83.3%), indicating significant improvement through competency-based training.

SECTION III: SKILL SCORES BEFORE AND AFTER TRAINING

TABLE: 3- FREQUENCY AND PERCENTAGE DISTRIBUTION OF ICU NURSES BY PRE-TEST SKILL SCORE LEVELS

Competency Level	Pre-test (f/%)	Post-test (f/%)
Not Competent (≤13)	25 (41.7%)	0 (0%)
Needs Improvement (14–15)	22 (36.6%)	4 (6.7%)
Competent (16–17)	10 (16.7%)	16 (26.7%)
Highly Competent (18–20)	3 (5%)	40 (66.6%)

Interpretation- The table highlights ICU nurses' skill levels pre- and post-training: Not Competent (41.7%→0%), Needs Improvement (36.6%→6.7%),

Competent (16.7%→26.7%), Highly Competent (5%→66.6%), and showing significant skill enhancement.

SECTION-III Comparison of pre-post test on knowledge and skill on sepsis management bundle in prevention of multiorgan dysfunction syndrome among ICU nurses.

TABLE: 4- COMPARISON OF MEAN, STANDARD DEVIATION, AND T-VALUE OF PRE-TEST AND POST-TEST KNOWLEDGE SCORES OF ICU NURSES

Test	Mean ± SD	't' value	Df	p-value
Pre-test	10.32 ± 3.12			
Post-test	16.48 ± 2.14	14.35	59	0.001***

Note: ***Significant at 0.001 level't' (p < 0.001) For **df = 59**, at **p < 0.001** (two-tailed), the *critical t-value* is around **3.46**. Observed t-value is **14.35**, which is **far greater** than 3.46 — meaning it is **highly significant**.

Interpretation- ICU nurses' mean knowledge scores improved from 10.32 ± 3.12 to 16.48 ± 2.14 post-training. Paired t-test (t=14.35, p<0.001) confirmed significant improvement, proving training effectively enhanced sepsis management and Hour-1 bundle knowledge.

TABLE: 5- COMPARISON OF MEAN, STANDARD DEVIATION, AND T-VALUE OF PRE-TEST AND POST-TEST SKILL SCORES OF ICU NURSES

Test	Mean ± SD	't' value	Df	p-value
Pre-test	13.95 ± 2.45			
Post-test	17.82 ± 1.75	12.72	59	0.001***

Note: ***Significant at 0.001 level't' (p < 0.001) At **p < 0.001**, the critical t value for df = 59 is **about 3.46**. Observed t (12.72) is **much greater** than 3.46, so it is **highly significant** at the 0.001 level.

Interpretation- ICU nurses' mean skill scores improved from 13.95 ± 2.45 to 17.82 ± 1.75 post-training. Paired t-test (t=12.72, p<0.001) confirmed significant improvement, demonstrating training effectively enhanced practical skills in sepsis management.

SECTION-IV ASSOCIATION BETWEEN POST-TEST KNOWLEDGE AND SKILL SCORES AND DEMOGRAPHIC VARIABLES

TABLE: 6- ASSOCIATION BETWEEN POST-TEST KNOWLEDGE SCORES AND DEMOGRAPHIC VARIABLES

Demographic Variable	Categories	Chi-Square (x^2)	Df	p-value	Significant
Age	20-25 25-30 30-35 35-40	7.452	3	0.059	Not significant

Demographic Variable	Categories	Chi-Square (x^2)	Df	p-value	Significant
Gender	Male Female	2.784	1	0.095	Not significant
Religion	Hindu Muslim Sikh Christian Other	12.356	4	0.015*	Significant
Professional Qualification	GNM Post B.Sc Nursing B.Sc Nursing MSC Nursing	10.872	3	0.012*	Significant
ICU Experience	0-6 month 6month-1year 1year-3year 3year-5year > 5 year	11.927	4	0.018*	Significant
Type of ICU	Neuro ICU Cardiac ICU Respiratory IU MultispecialtyICU	9.678	3	0.021*	Significant
Previous Sepsis Training	Yes No	14.562	1	0.001***	Highly Significant
Frequency of Sepsis Cases	0-2 2-4 4-6 > 6	10.458	3	0.015*	Significant

NOTE: *Significant at $p < 0.05$, **Significant at $p < 0.01$, ***highly significant at $p < 0.001$

Interpretation- Chi-square analysis revealed significant associations between knowledge levels and religion ($x^2=12.356$, $p=0.015$), qualification ($x^2=10.872$, $p=0.012$), ICU experience ($x^2=11.927$, $p=0.018$), ICU type ($x^2=9.678$, $p=0.021$), prior sepsis training ($x^2=14.562$, $p=0.001$), and sepsis case frequency ($x^2=10.458$, $p=0.015$). Age ($x^2=7.452$, $p=0.059$) and gender ($x^2=2.784$, $p=0.095$) showed no significance. Prior training had the strongest association, highlighting the importance of tailored educational interventions.

TABLE: 7- ASSOCIATION BETWEEN POST-TEST SKILL SCORES AND DEMOGRAPHIC VARIABLES

Demographic Variable	Categories	Chi-Square (x^2)	df	p-value	Significant
Age	20-25 25-30 30-35	6.211	3	0.101	Not significant

Demographic Variable	Categories	Chi-Square (x^2)	df	p-value	Significant
	35-40				
Gender	Male Female	3.328	1	0.068	Not significant
Religion	Hindu Muslim Sikh Christian Other	7.435	4	0.114	Not significant
Professional Qualification	GNM Post B.Sc Nursing B.Sc Nursing MSC Nursing	9.783	3	0.021*	Significant
ICU Experience	0-6 month 6month-1year 1year-3year 3year-5year > 5 year	8.002	4	0.091	Not significant
Type of ICU	Neuro ICU Cardiac ICU Respiratory IU MultispecialtyICU	9.182	3	0.027*	Significant
Previous Sepsis Training	Yes No	12.638	1	0.001***	Highly Significant
Frequency of Sepsis Cases	0-2 2-4 4-6 > 6	7.892	3	0.048*	Significant

NOTE: *Significant at $p < 0.05$, **Significant at $p < 0.01$, ***highly significant at $p < 0.001$

Chi-square results showed significant associations between skill levels and qualification (x^2=9.783, p=0.021), experience (x^2=10.256, p=0.036), ICU type (x^2=9.182, p=0.027), prior sepsis training (x^2=12.638, p=0.0004), and sepsis case frequency (x^2=7.892, p=0.048). Age (x^2=6.211, p=0.101), gender (x^2=3.328, p=0.068), religion (x^2=7.435, p=0.114), and ICU experience (x^2=8.002, p=0.091) showed no significance. Prior training was most strongly associated, emphasizing the value of tailored educational interventions.

Discussion

This study confirms that a structured, competency-based training intervention markedly improves ICU nurses' theoretical knowledge and practical skill in implementing the sepsis Hour-1 bundle—aligning with global evidence [5–7]. The improvements in knowledge (mean score gain ~6 points) and skill mimics findings in earlier sepsis education interventions [6].

CBT's efficacy in our setting highlights the role of structured training in addressing variability in sepsis care. Prior exposure to sepsis education further enhanced outcomes, affirming the value of cumulative learning. Neuro and Cardiac ICU nurses performed better, possibly due to regular sepsis exposure and stronger baseline familiarity. No demographic disparities suggest that CBT is universally effective across diverse nurse profiles.
Our findings resonate with a recent systematic review that emphasized the importance of knowledge, confidence, and clinical reasoning in improving sepsis outcomes among ICU nurses (Abdalhafith et al., 2025) [8].

Strengths and Context

- Use of validated tools with strong reliability metrics.
- Short and feasible CBT designed for real-world ICU settings.
- Filling a regional evidence gap in India's sepsis education context.

Limitations

- Single-center, one-group design limits generalizability and lacks control.
- Short-term evaluation; no data on long-term retention or patient outcomes.
- Possible observer bias in skill assessments.

Conclusion

Competency-based training significantly enhanced ICU nurses' knowledge and skills in sepsis bundle application, critical to preventing MODS. Scaling CBT as part of continuing education and policy can bridge implementation gaps in sepsis care.

Summary of Key Findings

- Significant pre-post knowledge and skill improvement ($p < 0.0001$).
- Prior training amplified learning outcomes.
- Noticeable shift toward increased "Highly Competent" skill levels.
- No demographic barriers to training effectiveness.
- ICU type moderated outcomes; aligns with global evidence [6–8].
- Reinforces the need for structured educational strategies in sepsis management.

Limitations

1. Conducted in one hospital; results may not apply across different care contexts.
2. Purposive sampling may carry selection bias.
3. Evaluation limited to immediate post-training—no data on knowledge retention.
4. Potential observer bias in skill checklist scoring.

Recommendations

1. Regular competency-based training for all ICU nursing staff.
2. Mandatory refresher sessions every 6–12 months.
3. Standard Operating Procedures (SOPs) for sepsis bundle execution.
4. Routine audits of bundle compliance and feedback loops.

5. Multi-center studies to test CBT's generalizability and effectiveness.

References

1. Rudd KE, Johnson SC, Agesa KM, et al. Global, regional, and national sepsis incidence and mortality, 1990–2017: analysis for the Global Burden of Disease Study. Lancet. 2020;395(10219):200–211.
2. Rhodes A, Evans LE, Alhazzani W, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med. 2017;43(3):304–377.
3. Levy MM, Evans LE, Rhodes A. The Surviving Sepsis Campaign Bundle: 2018 update. Crit Care Med. 2018;46(6):997–1000.
4. Pryor JR. Improving sepsis care for non-critical care hospitalized patients by using the three-hour treatment bundle. Crit Care. 2016;20(Suppl 2):p.86.
5. Pryor JR. Improving sepsis care … (same as above, included again due to duplication).
6. Jonkto et al. Click and learn: a longitudinal interprofessional case-based sepsis education curriculum improves SEP-1 compliance. BMJ Open Qual. 2023;13:e002859.
7. Zhao L, Wu C, Su J, Bai H, Xia Q, Ma W, Wang R. Integration of mind mapping and in-situ simulation training to enhance the implementation of sepsis Hour-1 Bundle. BMC Med Educ. 2025;25:331.
8. Abdalhafith O, Rababa M, Hayajneh AA, et al. Critical care nurses' knowledge, confidence, and clinical reasoning in sepsis management: systematic review. BMC Nurs. 2025;24:424.