Impact of ABCDEF Bundle Application on Nurses' Performance and Patients' Outcomes in Critical Care Units

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Abstract

Background: Critically ill patients experience a variety of distressing symptoms during their intensive care stay including pain, agitation, delirium, weakness, and sleep deprivation. Because of the complexity of caring for those patients, these symptoms are often managed by the "ABCDEF" bundle that improves intensive care unit outcomes. **Aim**: Evaluate the impact of "ABCDEF" bundle application on nurses' performance and patients' outcomes in critical care units. **Design**: A quasi-experimental design (pre/posttest for nurses and study/control for patients) were utilized to evaluate the impact of "ABCDEF" bundle application on nurses' performance and patients' outcomes in critical care units. **Setting**: The study was performed at medicine ICU affiliated to Ain Shams University Hospitals, Cairo. Egypt. **Subjects**: A convenient sample of all available nurses (30) working at medicine ICU &A purposive sample of (50) adult patients from both gender and free from mental disability recruited to this study from the previous mentioned setting. **Tools**: Tool (I) Nurses self-administered structured knowledge questionnaire, Tool (II) Nurses' practice observational checklist & Tool (III): Patients outcomes assessment record. **Results:** showed that there was an obvious statistical enhancement in the studied nurses' total satisfactory level of knowledge and practice immediate and post implementation of "ABCDEF" bundle application at p<0.05, in addition to there was statistically significant improvement in patients 'outcomes in the study group rather than the control group atp<0.05 except for mortality rate. **Conclusion:** In view of the findings, the research hypothesis has been proved as the application of "ABCDEF" bundle has a positive effect on nurses' performance; as it improved their knowledge and practical level and consequently has a positive effect in refinement the outcomes for patients in the study group rather than the control group with a statistically significant difference. **Recommendations:** Conducting In-service training programs regarding ABCDEF bundle application for nurses caring of patients in the intensive care unit.

Keywords: ABCDEF Bundle, Nurses' Performance, Patients' Outcomes in Critical

Introduction

The ABCDE bundle is a multidisciplinary approach to patient care that is used by nurses, physicians, and rehabilitation specialists to improve critically ill patients 'outcomes. Also, it can be utilized for every patient to exclude the consequences associated with intensive care unit admission. ABCDEF bundle in the intensive care unit is applied to develop and optimize pain management and choice of sedation, reduce delirium, duration of mechanical ventilation, ICU acquired weakness and sleep disturbance and encourage greater ICU patients and family involvement in the care process **(Sosnowski, et al., 2022).**

The ABCDEF bundle signifies an evidence-based guide for clinicians to approach the organizational changes needed for enhancing ICU patient recovery and outcomes. It includes: Assess, Prevent, and Manage Pain, Both Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT), Choice of analgesia and sedation, Delirium: Assess, Prevent, and Manage, Early mobility and Exercise, and Family engagement and empowerment **(Marra, et al., 2017).**

The intensive care unit (ICU) Liberation Bundle (A-F) is unique because it can be used to every patient, every day, by the full team. By encouragement a holistic approach to treating

patients and improving ICU team communication, the ICU Liberation Bundle has been proven in multiple studies including more than 20,000 patients to decrease the likelihood of hospital death within seven days by 68%, Reduce delirium and coma days by 25% to 50%, Lessen physical restraint use by more than 60%, Cut ICU readmissions in half and Reduce discharges to nursing and rehabilitation facilities by 40%**(Society of Critical Care Medicine (SCCM), 2020).**

Critical care nurse accountabilities include evaluating a patient's condition and administering treatment, as well as providing continuous support throughout recovery time. Nurses play unique role in the implementation of ABCDEF as they are critical to all requirements for effective implementation. Registered nurses lead protocol-guide sedation efforts that include daily spontaneous awakening trials and measurements of delirium and sedation/agitation using validated instruments **(Collinsworth, et al., 2021).**

Significant of study

Due to the increased complexity in healthcare and with the struggle to improve the quality of care and safety of patients, many healthcare organizations strive to enhancement quality care improvement. Nurses can be the frontline staff in scoping adverse events that occur in the intensive care units; therefore, education is a fundamental issue in this setting. Based on the review of the literatures, ABCDEF bundle program will be applied to improve nurses' knowledge, practice and clinical outcomes of patients to enhance the quality of care provided forthe patients in critical care units.

Aim of the study

Evaluate the impact of ABCDEF bundle application on nurses' performance and patients' outcomes in critical care units. This aim will be achieved through the following objectives:

1) Assessing nurses' level of performance pre ABCDEF bundle application in critical care units.
2) Assessing patients (control group)outcomes pre ABCDE bundle application in critical care units.
3) Design &Apply ABCDEF bundle program in critical care units.

Assessing nurses' level of performance post ABCDEF bundle application in critical care units.
4) Assessing patients (study group) outcomes post ABCDEF bundle application in critical care units.

Research Hypotheses

In order to achieve the aim of this study, it was hypothesized that application of ABCDEF bundle program in critical care units will lead to a positive improvement on nurses' level of performance and patients' outcomes.

Subject & Method

Study design: A quasi-experimental design (pre/posttest for nurses and study/control for patients) were utilized to evaluate the impact of ABCDEF bundle program application on nurses' performance and patients' outcomes in critical care units

Setting:
The study was performed at medicine ICU affiliated to Ain Shams University Hospitals, Cairo. Egypt.

Subjects:
A convenient sample of all available nurses (30) working at medicine ICU recruited to this study after their confirmation to participate in the study.

A purposive sample of (50) adult patients newly admitted from both gender regardless to their conscious level recruited to this study from the previous mentioned setting. The studied patients were divided into two groups: the control group (25 patients) whom received nursing care pre ABCDEF bundle program application and the study group (25 patients) whom received the nursing care post ABCDEF bundle program application.

Sample size
A sample size of (50) patients' needs to be recruited to achieve confidence level 90%. The sample size was calculated by adjusting the power of the test to 80% and the confidence interval to 90% with margin of error accepted adjusted to 5% and using the following equation:
Type I error (a) = 0.05
Type II error (B) = 0.2
With power of test 0.80

Tools of data collection:

Three tools were used for data collection to conduct this study:

Tool (I) Nurses self-administered structured knowledge questionnaire.

It was designed by the researchers after reviewing the recent related literatures**(Barnes- Daly et al., 2018, Pun et al., 2019, Balas et al., 2022, Moraes et al., 2022&King et al., 2023).**It included 2 parts:

Part (A):Nurses' demographic characteristics*:* It was used to assess studied nurses' data regarding; age, gender, qualifications, training sessions and years of experience.

Part (B): ABCDEF bundle knowledge assessment questionnaire. This part was used to assess nurses' level of knowledge pre and post ABCDEF bundle program application in medicine ICU. It was consisted of the following six main topics: **A**; assess, prevent and mange pain, **B**; both spontaneous a wakening trial (SAT) and spontaneous breathing trials (SBT), **C**; choice of analgesia and sedation, **D**; delirium: assess, prevent and manage, **E**; early mobility and exercise and **F**; family engagement and empowerment. The questionnaire consisted of 37 questions in the form of multiple choices questions (MCQ), including; ABCDEF bundle definition and purpose (Two MCQs), assessment, prevention and management of pain (eight MCQs), Spontaneous Awakening and Breathing Trials (five MCQs), Choice of analgesia and sedation (six MCQs), delirium risk factors assessment, treatment and prevention (seven MCQs), ICU early mobility and changing patients positions (five MCQs), family engagement in patient care and recovery (four MCQs).

Scoring system:

The correct answer of nurses' knowledge scored by one, while the incorrect answer scored by zero. Total score was 37 degrees, and it was considered that≥ 95 % (≥35.2 grades) was satisfactory while < 95% (<35.2 grades) was unsatisfactory.

Tool (II) Nurses' practice observational checklist*:* it was used to assess nurses' level of practice pre and post ABCDEF bundle program application in medicine ICU. It included the following parts: **part (1);**Assess nurses' practice during Pain assessment for conscious patients using Numerical Rating Scale (NRS) (six steps) which was adopted from **Mc Caffery et al., (1989)**and Behavioral Pain Scale (six steps) for unconscious patients which was adopted from **Payen et al., 2001,part (2);** Both Spontaneous Awakening and Breathing Trials for ventilated patients using Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT) protocol(eight steps) which was adopted from **Girard et al., (2008),part (3);**Choice of analgesics using Richmond Agitation Sedation Scale (RASS)(six steps) which was adopted from **Sessler et al., (2002),part (4);**Delirium assessment using

(Confusion Assessment Method- ICU) CAM-ICU assessment tool (eight steps)adopted from **Inouyeet al.,(1990)**, **part (5);**Early Mobilization for conscious and un conscious patients (27 steps)and **part (6);**Family Engagement in caring for patients during their stay in ICU(11 steps) which was adopted from **Helwan et al., (2021).**

Scoring system:
The correct step was scored with one, while the incorrect step was scored with zero with total score 72 degree and categorized into satisfactory and unsatisfactory as following:
-Satisfactory level ≥95% (≥68.4grades)
-Unsatisfactory level <95% (<68.4grades)

Tool (III): Patients outcomes assessment record: It was developed by the researchers to assess patients' outcomes pre and post ABCDEF bundle application in the previous mentioned setting including the following clinical outcomes; occurrence of pain episodes, ventilator days**,** occurrence and duration of delirium, occurrence of agitation and physical restrain, length of stay, and mortality rate.

Validity &Reliability: Content validity; the revision of the tools done by a panel of five expertise's (three professors and assistant professors in critical care and emergency nursing- at Faculty of Nursing-Ain Shams University); and two ICU physicians (two lecturer at Faculty of Medicine-Ain Shams University)to evaluate the content validity of the tools and modifications were done.

The reliability; was tested for the tool I; part II &Tool III by using alpha Cronbach's test (0.791, and 0.803respectively), those values indicated moderate to high reliability of the used tool.

Pilot study: It was conducted on 10% (three nurses and 5 patients)from previously mentioned setting to evaluate the applicability and clarity of the tools, it was done to estimate the time required to fill the tools. There wasn't any modification done regarding nurses assessment tools so, the nurses in the pilot study were included in the study while, there was minimal modification regarding patients outcomes assessment record so, those patients were excluded from the study.

Field work:
Data were collected by the researchers within seven months from April2023 to October 2023.

Assessment phase

This phase involved data collection prior to ABCDEF bundle program application to assess the nurse's and patient's baseline data.

- Ethical approval to conduct the study was received from scientific research ethics committee faculty of nursing-Ain Shams University under study number (23.07.101) and also from the hospital directors, after clarifying the aim of the study.

- All nurses under study were interviewed by the researchers in the previous mentioned setting and purpose of the study was explained to them.

- Before starting ABCDEF bundle program application, data was collected to assess nurses' knowledge, and practice regarding ABCDEF bundle application using Tool (I) (Part 1& 2)and Tool (II), it took almost three weeks as following:

▪ Nurses self-administered structured knowledge questionnaire (Part 1 & 2) was given for nurses individually to fill the required data regarding ABCDEF bundle application. It took about 30-40 minutes to be filled.

▪ Tool (II) Nurses' practice observational checklist was used by the researchers to observe nurses' practice toward pain assessment, following algorithms during both spontaneous a wakening trial (SAT) and spontaneous breathing trials (SBT), choice of analgesia and sedation, delirium assessment in collaboration with the health team member. Also, early mobility and family engagement during care of patients in the intensive care unit.

▪ In conjunction with the assessment of nurses' knowledge and practice, Tool (III) Patients outcomes assessment record, was filled by the researchers for the first (25) patients who were selected to be a control group during the shift while the nurses were given them the nursing care pre ABCDEF bundle program application in intensive care unit.

Planning phase:

Based on data collection, the researchers designed a booklet regarding ABCDEF application in an Arabic language to be suitable for all nurses regardless to their qualification level.

The booklet was consisted of the following six chapters; Chapter (1) A; assess, prevent and mange pain; understand pain physiology and recognize different tool for pain assessment and select the suitable tool according to patient condition and be aware of different treatment modalities and prevention. Chapter (2) **B**; both spontaneous a wakening trial (SAT) and spontaneous breathing trials (SBT), including The SAT& SBT safety screen &SAT failure criteria. Chapter (3)**C**; choice of analgesia and sedation, including understanding importance of the depth of sedation by using different scale. Chapter (4) **D**; delirium: assess, prevent and manage, including understanding delirium risk factors and apply tool for delirium assessment, treatment and prevention. Chapter (5) **E**; early mobility and exercise involving active or passive range of motion exercise and changing the patient position according to patient's conscious level. Chapter (6) **F**amily engagement and empowerment involving the family in patient care.

Implementation phase

The nurses were divided into six groups, each group consisted of five nurses. Every group received three sessions; the time of each session ranged from 60-90 minutes before beginning of their shifts. Teaching methods as demonstration, re-demonstration, and videos were used to provide the studied nurses with the essential knowledge and practice regarding ABCDEF bundle application. Also, they were allowed to discuss any issues concerned with ABCDEF bundle application within the session. The manual booklet was given to each nurse participated in the study,

Evaluation phase:

Nurses' knowledge and practice were evaluated two times; immediate and post 6 months by the researchers post ABCDEF bundle program application using Tool (I) (Part 1 & 2) and Tool (II). Regarding the outcomes of the studied patients (25 patients), were evaluated post ABCDEF bundle program application for nurses caring of them in the intensive care unit using Tool (III).

Ethical consideration:

The researchers explained the objectives and the aim of the study to nurses and patients included in the study. They were informed to participate or not and have the right to withdraw from the study at any time without giving any reason. The study followed common ethical principles in this research. Nurses' and patient under study confidentiality and anonymity were assured.

Statistical analysis: The data collected had reviewed, coded, analyzed and tabulated. Descriptive statistics (frequencies and percentages, mean and standard deviation) were done using computer program (SPSS)

version (26). Chi-square test used in the relationship between nurses' knowledge and practice post ABCDEF bundle program application with nurses' demographic data. Pearson correlation coefficient is used for quantitative variables (knowledge & practice).It's considered significant when P value less than(0.05).

Results:

Result in **table (1)**showed that, the mean age of the studied nurses was31.8 ±8.2and (76.7%) of them were female. According to their qualification, (40%) of the studied nurses had technical institute, and (36.7%) of them had Bachelor degree. As regard to their years of experience and training sessions, (70%) had experiences more than 10 years and (100%) did not receive any training sessions.

Table (2): clarified a comparison between the percentage distribution of the studied nurses 'total satisfactory level of knowledge and practice pre, immediate and post ABCDEF bundle program application and it showed that there was an obvious significant improvement in their satisfactory levels post ABCDEF bundle program application at (X^2 20.867, P= 0.021) for knowledge and ($X^2$21.082, 0.032) for practice.

Table (3) revealed that (46%) of the studied patients aged more than 60 years old. According to their gender, (58%) of the them were male.

Table (4) showed significant improvement between the study and control group clinical outcomes regarding Occurrence of pain episodes, ventilator days and Occurrence and duration of delirium and occurrence of agitation and physical restrain at (X^2 7.321, P= 0.021), ($X^2$7.679, P= 0.000), ($X^2$8.679, P= 0.000),($X^2$7.415, P= 0.033), & (X^2=6.211, P=0.000) respectively.

Table (5) represented that, there was a statistically significant difference between total satisfactory level of nurses' knowledge immediate and post ABCDEF bundle program application and their age, gender, qualification and years of experience at p <0.05 respectively.

Table (6)showed that there was a statistically significant difference between total satisfactory level of nurses' practice post ABCDEF bundle program application and their age, gender, qualification and years of experience at p < 0.05 respectively.

Table (7)outlined a positive correlation between total nurses' satisfactory level of knowledge and practice post ABCDEF bundle program application(r = 0.345at P=0.001).

Table (1): Frequency distribution of demographic characteristics of the studied nurses.

Items	(N=30)	%
Age group (years)		
18< 30	9	30
30 <40	17	56.7
40 ≤ 60	4	13.3
Mean±SD 31.8 ±8.2		
Gender		
Female	23	76.7
Male	7	23.3
Qualification		
Diploma	5	16.7
Technical institute	12	40
Bachelor degree	11	36.7
Master/ PHD	2	6.6
Years of experience		
<10	9	30
≥ 10	21	70
Training sessions		
Yes	0	0
No	30	100

Table (2): Percentage distribution of total nurses' satisfactory level of knowledge& practice pre, immediate and post ABCDEF bundle program application (no=30)

ABCDEF bundle program application	Total satisfactory level of Knowledge		X^2	P value	Total satisfactory level of Practice		X^2	P value
	No	%			No	%		
Pre	7	23.3	20.867	0.021*	8	26.6	21.082	0.032*
Immediate	25	83.3			26	86.6		
Post	23	76.7			25	83.3		

Non-significant P>0.05   ** Statistical significant P<0.05*

Table (3): Frequency distribution of Demographic characteristics of patients (n=50).

Demographic characteristics		N	%
Age	18-<40	10	20%
	40-<60	17	34%
	>=60	23	46%
Gender	Male	29	58%
	Female	21	42%

Table(4):Comparison between control and study group clinical outcomes of patients regarding ABCDEF bundle program application (n= 25 patients in each group).

Clinical outcomes regarding ABCDEF bundle application	Clinical outcomes of patients regarding ABCDEF bundle application					
	Control group		Study group		X^2	P value
	No	%	No	%		
Occurrence of pain episodes	22	44	16	64	7.321	0.021*
Ventilator days	7	28	3	12	7.679	0.000*
Occurrence and duration of delirium	9	36	4	16	8.679	0.000*
Occurrence of agitation and physical restrain	20	80	9	36	6.211	0.000*
Length of stay ≥ 7 days	18	72	11	44	7.415	0.033*
Mortality rate	5	20	3	12	4.233	0.400

Non-significant P>0.05   ** Statistical significant P<0.05*

Table (5): Relations between total satisfactory mean score of nurses' knowledge and demographic characteristics pre andpost ABCDEF bundle application(n=30).

Demographic characteristics	Total satisfactory level of nurses' knowledge					
	Pre ABCDEF application		Immediate ABCDEF application		Post 6 months ABCDEF application	
	N	%	N	%	N	%
Age						
18< 30	3	42.9	8	32	7	30.4
30 <40	3	42.9	15	60	14	60.9
≥40	1	14.2	2	8	2	8.7
Chi-Square (X^2, P)	$X^2=0.204$ P= 0.901		$X^2=6.804$ P= 0.041*		$X^2=5.992$ P= 0.014*	
Gender						
Male	2	28.6	4	16	3	13
Female	5	71.4	21	84	20	87
Chi-Square (X^2, P)	$X^2=0.032$ P= 0.816		$X^2=7.214$ P= 0.031*		$X^2=5.862$ P= 0.012*	
Educational level						
Diploma nurse	2	28.6	2	8	1	4.3
High institute nurse	3	42.8	11	44	10	43.5
Bachelor nurse	1	14.3	10	40	10	43.5
Master/ PHD	1	14.3	2	8	2	8.7
Chi-Square (X^2, P)	$X^2=3.452$ P= 0.361		$X^2=6.046$ P= 0.031*		$X^2=6.102$ P= 0.012*	
Years of experience						
<10	2	28.6	8	32	7	30.4
≥ 10	5	71.4	17	68	16	69.6
Chi-Square (X^2, P)	$X^2=0.052$ P= 0.821		$X^2=8.121$ P= 0.011*		$X^2=7.213$ P= 0.005*	

*Non-significant P>0.05   * Statistical significant P<0.05*

Table (6): Relations between total satisfactory mean score of nurses' practice and demographic characteristics pre and post ABCDEF bundle application (n=30).

Demographic characteristics	Total satisfactory level of nurses' Practice					
	Pre ABCDEF application		Immediate ABCDEF application		Post 6 months ABCDEF application	
	N	%	N	%	N	%
Age						
18< 30	3	37.5	9	34.6	8	32
30 <40	4	50	16	61.6	16	64
≥40	1	12.5	1	3.8	1	4
Chi-Square (X^2, P)	$X^2=0.215$ P= 0.991		$X^2=6.992$ P= 0.013*		$X^2=6.981$ P= 0.012*	
Gender						
Male	3	37.5	4	15.4	3	12
Female	5	62.5	22	84.6	22	88
Chi-Square (X^2, P)	$X^2=0.042$ P= 0.827		$X^2=7.315$ P= 0.040*		$X^2=5.991$ P= 0.022*	
Educational level						
Diploma nurse	2	25	2	7.7	1	4
High institute nurse	4	50	11	42.3	11	44
Bachelor nurse	1	12.5	11	42.3	11	44
Master/ PHD	1	12.5	2	7.7	2	8
Chi-Square (X^2, P)	$X^2=3.751$ P= 0.368		$X^2=6.125$ P= 0.035*		$X^2=6.561$ P= 0.032*	
Years of experience						
<10	2	25	8	30.8	7	28
≥ 10	6	75	18	69.2	18	72
Chi-Square (X^2, P)	$X^2=0.061$ P= 0.734		$X^2=8.442$ P= 0.031*		$X^2=7.512$ P= 0.007*	

*Non-significant P>0.05   * Statistical significant P<0.05*

Table (7): Correlation between total nurses' satisfactory level of knowledge and practice pre &post6 months ofABCDEF bundle application.

Total satisfactory level of Knowledge	Total satisfactory level of practice			
	Pre		post	
	r test	P value	r test	P value
Pre	0.629	0.371		
Post			0.345	0.001*

Non-significant P>0.05   ** Statistical significant P<0.05*

Discussion:

Continuing education and staff development, is the target to help the nurses maintaining and improving their competencies as required for the delivery of quality care to the consumer.

The discussion of this study finding supporting our research hypothesis stated that application of ABCDEF bundle in critical care units will lead to a positive improvement on nurses' level of performance and patients' outcomes.

The present study revealed that, mean age of studied nurses was 31.8 ±8.2,with the majority of the studied nurses aged from 20<40 years. This finding may be due to that the majority of studied nurses were newly graduated. This result is in accordance with **Helwan et al., (2019)**in the study entitled "Assess Nursing Performance During Implementation of Care Bundle for Critically ill Patients" whom found that mean age of studied nurses was 29.32 ± 6.77 ranged from 20 < 35 years. As regard to gender, the current study found that, more than three quarters of the studied nurses were females, these results were in the same line with **Erbay Dalli, et al., (2023)** in their study entitled "Practices of the ABCDEF care bundle in intensive care units as reported by nurses" and revealed that the majority of them were female (81.9%).

In relation to the educational level, the current study showed that, more than one third had technical institute degree. This result may be due to the highest percentage of them rejoin faculties of nursing at recent days due to presence of different equivalency certificate provided by higher ministry of education. Regarding to years of experience, less than three quarters had experiences more than 10 years, this matched with the result of this study as more than half ranged from 30<40.This result contradicted with

Helwan et al., (2019)who found that near one quarter had more than 10years of clinical experience. Also, the present study revealed that all of the studied nurses did not receive any training sessions. This may be due to nurses' disability to attend training courses because of work over load.

Regarding nurses 'total satisfactory level of knowledge and practice pre, immediate and post ABCDEF bundle program application, the present study stated that there was insignificant improvement in their satisfactory levels immediate &post ABCDEF bundle application. They demonstrated a significant difference compared to their pre level. The improvement due to the present ABCDEF bundle application program using sessions for theoretical and practical content which was given to the studied nurses with continuous explanations, reinforcement and feedback as well as sufficient materials and videos were provided for training. A substantial need for educational improvement and cultural change is needed. Comprehensive educational session regarding ABCDEF bundle application should beheld regularly. An appropriate clinical guidelines and protocols should be developed for safe clinical practices and reducing morbidity and mortality rate.

The researchers justifies nurses' unsatisfactory level of knowledge and practice pre ABCDEF bundle application that the nurses didn't attend any training sessions. Also, near half of the studied nurses were technical institute graduates. Therefore, lack of continuous training sessions contribute to the problem.

Significant improvement post program implementation might be due to the effect of the ABCDEF program application which did not only stress the acquisition of knowledge but also stressed on practical training to gain information and change work practice using adequate sessions, different teaching strategies as discussion, lecture, demonstration and re-demonstration, using media as handout including pictures and knowledge as well as

availability of sufficient materials and videos needed for achievement of the work. All studied nurses in the program had received a handout of the program content. Also, recurrent reinforcement for both knowledge and practice were done in each session.

Implementing daily multidisciplinary rounds for all ICU patients, providing sustained and multimodal staff educational efforts, promoting high-quality consistent implementation of the interventions within the bundle, and thoroughly documenting all actions to promote compliance have all been cited as effective measures to successfully implement the ABCDE bundle.

This result in accordance with **Pinto & Biancofiore (2016)** in their study "The ABCDE bundle: A survey of nurses knowledge and attitudes in the intensive care units of a national teaching hospital in Italy" whom found that only the 41.6% of the respondents declared to be aware of the bundle.

Balas et al., (2022) in their study "Effects of a national quality improvement collaborative on ABCDEF bundle implementation" stated that Performance rates increased significantly immediately after initiation for pain assessment (7.6% [SE, 2.0%], P = .002), sedation assessment (9.1% [SE, 3.7%], P = .02), and family engagement (7.8% [SE, 3%], P = .02) and then increased monthly at the same speed as the trend in the baseline period. Performance rates were lowest for spontaneous awakening/breathing trials and early mobility.

As regard to demographic data of patients, the present study revealed that (46%) of the studied patients aged more than 60 years old and according to their gender, more than half of the them were male. This go in the same line with **Brown, et al., (2022)** in the study titled "Improving ABCDEF bundle compliance and clinical outcomes in the ICU: Randomized control trial to assess the impact of performance measurement, feedback, and data literacy training", who found that mean age of the studied patients was 59.8 and more than half of them were male.

In relation to Comparison between control and study group clinical outcomes of patients regarding ABCDEF bundle application, the present study stated significant differences between the study and control group clinical outcomes regarding Occurrence of pain episodes, ventilator days, Occurrence and duration of delirium, Occurrence of agitation and physical restrain and Lengthof stay ≥ 7 days except for Mortality rate.

Experts are calling for ABCDE bundle implementation as a standard of care for every ICU patient. As likened with pre-bundle and post-bundle data, significant episodes of pain varied with bundle performance. Hospital LOS decreased, a finding that is supported in the literature that the ABCDE bundle may reduce the length of both overall and ICU LOSs. Documentation of the awakening and breathing was completed all of the time, and there were lower ventilator days in the post-bundle group. These findings are consistent with other studies that also noted a decrease in number of ventilator days per patient after implementation of coordinated awakening and breathing trials. ABCDEF bundle statistically significantly decreased the duration of intensive care unit delirium

These study results matching the study results of **Kram et al., (2015)** in their study entitled "Implementation of the ABCDE bundle to improve patient outcomes in the intensive care unit in a rural community hospital" and found that implementation of the bundle decreased average patient hospital length of stay by 1.8 days, reduced length of mechanical ventilation by an average of 1 day, and recognized a baseline delirium prevalence of 19% over a 3-month time period. The ABCDE bundle can be applied in hospitals and provides a safe, cost-effective method for enhancing ICU patient outcomes.

Also, these results go in the same line with **Bounds et al., (2016)** in study titled "Effect of ABCDE bundle implementation on prevalence of delirium in intensive care unit patients", and stated that after implementation of the ABCDE bundle, the prevalence of delirium decreased significantly (from 38% to 23%, P = .01) and the mean number of days of delirium decreased significantly (from
3.8 to 1.72 days, P < .001). The number of patients with delirium-free stays increased after bundle implementation. Implementation of the ABCDE bundle led to significant decreases in the prevalence and duration of delirium in ICU patients. In addition to **Frade & Mera, et al., (2022)** in their study "The impact of ABCDE bundle implementation on patient outcomes: A nationwide cohort study" found that the implementation rate of ABCDE bundle components resulted in shorter ICU stay, more analgesia dosing, and lighter sedation.

Moraes et al., (2022) in their study about "ABCDE and ABCDEF care bundles: A systematic review of the implementation process in intensive care units" showed that implementation of the bundles may reduce length of ICU stay, mechanical ventilation time, delirium, ICU and hospital mortality, and promoted early mobilization in critically-ill patients

As regard to relation between total nurses' satisfactory level of knowledge post ABCDEF bundle application and nurses' demographic data. This study showed a statistically significant difference between total satisfactory level of nurses' knowledge immediate and post ABCDEF bundle application and their age, gender, educational level and years of experience. These results may be due to that more than one third of the studied nurses had bachelor degree and near three quarters had more than 10 years of experience**.**

As regard to relation between total nurses' satisfactory level of practice post ABCDEF bundle application and nurses' demographic data, there was a statistically significant difference between total satisfactory level of nurses' practice post ABCDEF bundle application and their age, gender, educational level and years of experience.

As regard to correlation between total nurses' satisfactory level of knowledge and practice post ABCDEF bundle program application. The study result outlined a positive correlation between nurses' knowledge and practice. The knowledge is necessary for nurses to improve their practice. This is based on the recognition that nursing knowledge production must also be viewed in conjunction with practice as practice invades not only the use of knowledge but also gaining of knowledge. Nursing competencies depend largely on intuitive knowledge and skills. Therefore, the reasons for nurses, improper performance are usually the lack of nurses' knowledge and skills. This result also matches with **Helwan et al., (2019)**in their study which revealed that there was positive correlation between nurses' knowledge and practice.

Conclusion:

In view of the findings, the researches hypothesis has been proved as the application of ABCDEF bundle has a positive effect on nurses' performance; as it improved their knowledge and practical level and consequently has a positive effect in refinement the outcomes for patients in the study group rather than the control group with a statistically significant difference.

Recommendations:

- Conducting In-service training programs regarding ABCDEF bundle application for nurses caring of patients in the intensive care unit to improve their performance which considered a mile stone issue affecting patients' outcomes.

- Developing a system of periodical evaluation for nurses to determine strategies of upgrading their knowledge and enhancing their practice regarding ABCDEF bundle application.

References

Balas, M. C., Tan, A., Pun, B. T., Ely, E. W., Carson, S. S., Mion, L., ... &Vasilevskis, E. E. (2022). Effects of a national quality improvement collaborative on ABCDEF bundle implementation. American Journal of Critical Care, 31(1), 54-64.

Barnes- Daly, M. A., Pun, B. T., Harmon, L. A., Byrum, D. G., Kumar, V. K., Devlin, J. W., ... & Balas, M. C. (2018). Improving health care for critically ill patients using an evidence- based collaborative approach to ABCDEF bundle dissemination and implementation. *Worldviews on Evidence- Based Nursing*, *15*(3), 206-216.

Barr J, Fraser GL, Puntillo K, ; American College of Critical Care Medicine. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. Crit Care Med. 2013 Jan;41(1):263-306.

Bounds, M., Kram, S., Speroni, K. G., Brice, K., Luschinski, M. A., Harte, S., & Daniel, M. G. (2016). Effect of ABCDE bundle implementation on prevalence of delirium in intensive care unit patients. American Journal of Critical Care, 25(6), 535-544.

Brown, J. C., Querubin, J. A., Ding, L., Mack, W. J., Chen-Chan, K., Perez, F., ... & Cobb, J. P. (2022). Improving ABCDEF bundle compliance and clinical outcomes in the ICU: Randomized control trial to assess the impact of performance measurement, feedback, and data literacy training. Critical care explorations, 4(4).

Collinsworth, A. W., Brown, R., Cole, L., Jungeblut, C., Kouznetsova, M., Qiu, T., ... & Masica, A. L. (2021). Implementation and routinization of the ABCDE bundle: a mixed methods evaluation. Dimensions of Critical Care Nursing, 40(6), 333-344.

Devlin JW, Skrobik Y, Gélinas C, Clinical practice guidelines for the prevention and management of

pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. Crit Care Med. 2018 Sep;46(9):e825-e873.

Erbay Dalli, Ö., Akça Doğan, D., Bayram, R., Pehlivan, S., & Yildiz, H. (2023). Practices of the ABCDEF care bundle in intensive care units as reported by nurses: A cross- sectional study from Turkey. Nursing in Critical Care.

Frade- Mera, M. J., Arias- Rivera, S., Zaragoza-García, I., Martí, J. D., Gallart, E., San José-Arribas, A., ... &Raurell- Torredà, M. (2022). The impact of ABCDE bundle implementation on patient outcomes: A nationwide cohort study. *Nursing in Critical Care*, *27*(6), 772-783.

Girard TD, Kress JP, Fuchs BD, Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (awakening and breathing controlled trial): A randomized controlled trial. Lancet 2008 Jan;371(9607):126-34. PMID: 18191664.

Helwan Ismaiel, E., Talat Mohammed, E., Ali Ameen, D., & Abdallah Abdelatef, D. (2022). Assess Nursing Performance during Implementation of Care Bundle for Critically Ill Patients. Egyptian Journal of Health Care, 13(3), 182-193.

Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. Ann Intern Med. 1990;113(12):941-948.

King, A. J., Potter, K. M., Seaman, J. B., Chiyka, E. A., Hileman, B. A., Cooper, G. F., ... & Kahn, J. M. (2023). Measuring Performance on the ABCDEF Bundle During Interprofessional Rounds via a Nurse-Based Assessment Tool. American Journal of Critical Care, 32(2), 92-99.

Kram, S. L., DiBartolo, M. C., Hinderer, K., & Jones, R. A. (2015). Implementation of the ABCDE bundle to improve patient outcomes in the intensive care unit in a rural community hospital. Dimensions of critical care nursing, 34(5), 250-258.

Marra, A., Ely, E., Pandharipande, P. and Pate, M. (2017). The ABCDEF Bundle in Critical Care, Crit Care Clin. 33(2): 225–243. doi:10.1016/j.ccc.2016.12.005

McCaffery, M., Beebe, A., et al. (1989). Pain: Clinical manual for nursing practice, Mosby St. Louis, M

Moraes, F. D. S., Marengo, L. L., Moura, M. D. G., Bergamaschi, C. D. C., de Sá Del Fiol, F., Lopes, L. C., ... &Barberato-Filho, S. (2022). ABCDE and ABCDEF care bundles: A systematic review of the implementation process in intensive care units. *Medicine*, *101*(25), e29499-e29499.

Payen J, Bru O, Bosson J, Lagrasta A, Novel E, Deschaux I, Lavagne P, Jacquot C: Assessing pain in critically ill sedated patients by using a behavioral pain scale. Crit Care Med. 2001;29 (12);2258-2263.

Pinto, F., & Biancofiore, G. (2016). The ABCDE bundle: A survey of nurse's knowledge and attitudes in the intensive care units of a national teaching hospital in Italy. Dimensions of Critical Care Nursing, 35(6), 309-314.

Pun, B. T., Balas, M. C., Barnes-Daly, M. A., Thompson, J. L., Aldrich, J. M., Barr, J., ... & Ely, E. W. (2019). Caring for critically ill patients with the ABCDEF bundle: results of the ICU liberation collaborative in over 15,000 adults. *Critical care medicine*, *47*(1), 3.

Sessler CN, Gosnell MS, Grap MJ, The Richmond Agitation-Sedation Scale: validity and reliability in adult intensive care unit patients. Am J Respir Crit Care Med. 2002;166:1338-1344.

Sosnowski, K., Lin, F., Chaboyer, W., Ranse, K., Heffernan, A., & Mitchell, M. (2022). The effect of the ABCDE/ABCDEF bundle on delirium, functional outcomes, and quality of life in critically ill patients: A systematic review and meta-analysis. International Journal of Nursing Studies, 104410.