

Effectiveness of Developed Patients Safety Guidelines on Nurses' Performance and patients' outcomes at Intensive Care Units

Shaimaa Ali Mohamed Ismail ⁽¹⁾, Maaly Zayed Mohamed Ismail ⁽²⁾

(1) Lecturer, Nursing Administration Department, Faculty of Nursing, Cairo University, Egypt

(2) Lecturer, Nursing Administration Department, Faculty of Nursing, Cairo University, Egypt

Abstract

Background: Patient safety is the cornerstone of high-quality healthcare. Intensive care units (ICUs) are complex organizations that involve providers from multiple disciplines of patient care. Nursing interventions have a great impact on reducing the risk of complications for patients in ICUs. **Aim:** This study aimed to assess the effect of developed patient safety guidelines on nurses' performance and patient's outcomes. **Subjects and Methods: Research Design:** A quasi-experimental design was used to achieve the aim of the study. **Setting:** The study was conducted at selected ICUs at Cairo University Hospitals. **Subject:** A convenient sample of 60 nursing staff and 120 patients. **Tools of data collection:** Three tools were used as follows: 1) Nurses' knowledge about patient safety guidelines questionnaire, 2) Nurses' Patient safety practices observational checklist, and 3) Patients' safety outcomes checklist. **The results: Concerning the nurses;** the post-mean knowledge and practice scores of nurses regarding implementation of patients safety guidelines were higher than pre-implementation and there was a highly significant positive correlation between total nurses' knowledge and their practice pre- and post-implementation of patients safety guidelines. **While, regarding patients' outcomes,** control and study groups of patients were at mild risk with a highly statistically significant difference between pre- and post-implementation of patient safety guidelines related total Braden scale. Moreover, two studied patients' groups were at low risk with a highly statistically significant difference between pre- and post-implementation of patient safety guidelines related total fall risk assessment. In addition, two studied patients' groups were had mild pain with a highly statistically significant difference between pre- and post-implementation of patient safety guidelines related total critical pain assessment scale. **Conclusion:** There was a highly significant positive correlation between total nurses' knowledge and their practice at pre- and post-implementation of patients safety guidelines and there was an improvement in patient safety outcomes for the study group than the control group after one week with a statistically significant difference. **Recommendations:** The hospital administration should encourage the application of International Patient safety goals (IPSGs) procedures to improve nurses' safety performance.

Keywords: Nurse performance, Patient outcomes, and Patient Safety Goals (PSGs).

Introduction:

Safety is a fundamental principle of patient care and a critical component of quality management. Its improvement demands a complex system-wide effort, involving a broad range of actions in performance improvement, environment safety, and risk management, including infection control equipment safety safe clinical practice, and safe environment of care. It embraces nearly all health-care disciplines and actors, and thus requires a comprehensive, multifaceted approach to identifying and managing actual and potential

risks to patient safety in individual services and finding broad long-term solutions for the system as a whole (Greiner, 2019).

Patient Safety is a healthcare discipline that emerged with the evolving complexity in healthcare systems and rise of patient harm in healthcare facilities. It aims to prevent and reduce risks, errors, and harm that occur to patients during the provision of healthcare. A cornerstone of the patient safety discipline is a continuous improvement based on learning from errors and adverse events. Patient safety is fundamental to delivering quality essential

health services. Furthermore, to ensure the successful implementation of patient safety strategies there must be clear policies, leadership capacity, data to drive safety improvements, skilled healthcare professionals, and effective involvement of patients in their care, are all needed (WHO,2019).

Patient safety guidelines are evidence-based and established to improve the safety and quality of care provided to patients. Patient safety guidelines are intended to help accredited organizations, address specific areas of concern regards to patient safety. The patient safety guidelines specify the best clinical practice in several areas including; correct patient identification, communication among medical providers, the safe use of medications, infection prevention, patient safety from risks, prevention of surgical mistakes, and prevention of falls and pressure ulcer (Abdallah, 2019).

Furthermore, a lack of standard procedures for storage of medications that look alike, poor communication between the different providers, lack of verification before medication administration, and lack of involvement of patients in their care might all be underlying factors that led to the occurrence of errors. Traditionally, the individual provider who actively made the mistake active error would take the blame for such an incident occurring and might also be punished as a result. Unfortunately, this does not consider the factors in the system previously described that led to the occurrence of error latent errors. It is when multiple latent errors align that an active error reaches the patient (WHO,2019).

Nowadays, the healthcare context is highly complex, describing the safety culture in hospitals is an important first step in creating work environments where safety is a priority. It is a core component of healthcare quality. The safety culture of an organization is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of an organization's health and safety management. Organizations with a positive safety culture are characterized by communications founded on mutual trust, shared perceptions of the importance of safety, and confidence in the efficacy of preventive measures (Boadu, &Rehani, 2019).

Safety culture is defined as how safety is managed in a workplace. It is the combination of beliefs, perceptions, and attitudes of employees toward the safety of workers and the overall safety of the work environment. Cultivating a safety culture is a key aspect of maintaining workplace safety. A safety culture is an organizational culture that places a high level of importance on safety beliefs, values, and attitudes and these are shared by the majority of people within the company or workplace. It can be characterized as 'the way we do things around here. A positive safety culture can result in improved workplace health and safety (WHS) and organizational performance (Janssen & Rautmann,2019).

Element of safety culture Pennsylvania Patient Safety Collaboration, create a safer environment for patient safety by developing elements of safety culture including Open communication; a Blame-free environment; Safety design, Employee involvement, accountability, and Organizational commitment to providing patient safety. Open Communication Organization with a positive culture is characterized by communications founded on mutual trust, shared perceptions of the importance of safety, and confidence in the efficiency of preventive measures (Edwards, et al, 2018).

There is increasing concern about the link between the performances of nurses' practices and NPSGs which create an urgent need for a more understanding of the nature of clinical supervisory activities at an operational level. The vital purpose of clinical supervision is to improve patient care and experiences, therefore, improvements in patients' outcomes are a major sign of effective supervision (Timothy& Farlain,2019).

The patient safety goals were implemented successfully through putting clear policies, leadership capacity, and data to drive safety improvements, skilled health care professionals, and effective involvement of patients in their care. Recognizing patient safety is one of the most important components of health care delivery, as it is essential to achieving universal health coverage, to acknowledge the need for a strategic approach and collaborative action at all levels global, regional, and national (Vlayen, Claes, & Peleman ,2019).

Nurses play a key role in improving patient safety due to their continuous presence at patients' bedsides, and interaction with their families and other healthcare professionals, for instance, critical care unit nurses have often reported that they identified and corrected errors such as medication and procedural implement or related to nurses and other caregivers. Patient safety is an important element in offering high-quality health care services (Almalki Gerald, & Clark, 2019).

Significance of the problem:

Patient safety is a global health concern, affecting patients in all health care settings, whether in developed or developing countries. Research studies have shown that an estimated average of 10% of all inpatient admissions result in a degree of unintended patient harm. It is estimated that up to 75% of these lapses in health care delivery are preventable. In addition, human suffering, unsafe health care exacts a heavy economic toll. Indeed, it is estimated that 5–10% of expenditure on health is due to unsafe practices that result in patient harm. Most of this is due to system failures rather than the actions of individuals (Jain, Miller & Belt, 2019). Main Sentinel Events reports included; Unintended Retention of a Foreign Body (13.14%), Wrong-patient, wrong-site, wrong procedure (12.93%), Fall (10.15%), delay in treatment (8.76%), and post-operations Complication (8.76%) (Jha, 2018).

The risk of adverse transfusion reactions and transmission of infections from a group of 21 countries showed an average incidence of 8.7 serious reactions per 100 000 distributed blood components. In cases of wrong-patient and wrong-site identifications. Also, 30 years of published data in a review about safety in radiotherapy estimates that the overall incidence of errors was 1500 per one million treatment courses. Infections are often resistant to antibiotics, especially when not diagnosed early they could rapidly lead to deterioration in the clinical conditions, affecting an estimated 31 million people worldwide and causing over 5 million deaths per year (Leape, 2019). Therefore, it is important to apply patient safety guidelines to assess nurses' performance and its effect on patient outcomes to improve nurses' performance and prevent complications that developed in patients in ICU.

Aim of the study

The aim of this study is to assess the effect of developed patient safety guidelines on nurses' performance and patient outcomes.

To fulfill the aim of this study the following objectives were formulated:

1. Assessing nurses' performance (knowledge – practice) regarding the developed patient safety guidelines.
2. Implementing the developed patient safety guidelines based on nurses' needs assessment
3. Evaluating the effect of the developed patient safety guidelines on nurses' performance and patients' outcomes

Research Hypothesis:

1. The application of the developed patient safety guidelines will positively affect the nurses' performance (knowledge and practice) regarding patient safety measures.
2. The application of the developed patient safety guidelines will positively affect the patient outcomes

Operational definitions:

1. **Nurses' performance:** It refers to the means to assess nurses' knowledge and practice regarding patient safety.
2. **Patients' outcomes:** It refers to hospital-acquired infection, the average length of stay, and patient readmission.

Research design

A quasi-experimental had been used to achieve the aim of the study.

Setting:

This study was conducted at the selected ICUs in Cairo University hospitals as follows: 1) Critical Care Medicine Unit (First Unit), 2) Thoracic and Cardiac Intensive Care Unit, and 3) Stork unit.

Subjects:

The subjects of the study included two groups (a group of nurses and a group of patients).

I- The nursing group: Includes a convenient sample of 60 nursing staff who accept to participate in the study in the previously mentioned settings were observed and audited for performance regarding the application of developed patients' safety guidelines items from patients' admission to discharge and conduction of the developed patient's safety guidelines. Nurses are distributed in places as the following: 20 staff nurses at General surgery ICU and 10

staff nurses at neurological ICU were located at Hospital 185 for emergency and burns, 15 staff nurses at Thoracic and Cardiac Intensive Care Unit, and 15 staff nurses at Stork unit.

II- Patient samples include two groups: The patients' group consisted of a convenient sample of 120 patients divided into two group study and a control admitted to the hospital to be assessed, checked, and observed for the application of developed patients safety guidelines items related process as (patient identification, effective communication, fall risk, and infection highlighting) or all what related to care such as (infection control bundles, medications management, universal OR protocol) and assess readmission for the patients during and which cause complications or surgical site infection after the implementation of the developed patient's safety guidelines educational program.

Tools of data collection:

Data for the present study were collected by using the following three tools.

A) For nurses:

Tool I: Nurses' knowledge about patient safety guidelines questionnaire:

It is a self-administered questionnaire and was developed by Hasaballah et al., (2019) and modified by the investigator to assess nurses' knowledge related to patients' safety. It comprised two parts:

Part 1: Personal characteristics data sheet that was developed by the investigators and including nurses' age, gender, marital status, educational level, position, years of work experience in the ICU, and attendance of training programs about patients' safety.

Part 2: It is used to assess nurses' knowledge regarding patient safety guidelines. It includes nine parts including:

1- Patient identification (20 MCQ questions); 2- Effective Communication (28 MCQ questions); 3- Safety of using Medications (28 MCQ questions); 4- Safe surgery protocol (16 MCQ questions); 5- Health Care-Associated Infections (16 MCQ questions); 6- Risk of Patient Harm Resulting from Falls (12 MCQ questions); 7- Rapid response team and cod blue team (16 MCQ questions); 8- Keep patient confidentiality and privacy (4 MCQ questions),

and 9- Keep intact skin and prevent pressure ulcers (4 MCQ questions).

Scoring system:

The correct answers were given one score and the wrong answers were given zero scores. These scores were summed-up and converted into a percent score. The total Nurses' response points about knowledge regarding patient safety guidelines were 144 equal (100%) where a score from total knowledge $\geq 80\%$ referred to satisfactory knowledge that equal (≥ 115 marks) and a score from $< 80\%$ referred to unsatisfactory knowledge that equal (< 115 marks).

Tool II: Nurses' Patient safety practices observational checklist:

It was developed by McCutcheon & Doyle, (2015); that modified by the investigator to suit the nature of the study after reviewing of related literature. It was used to assess the nurses' practices related to safety measures in the ICU unit such as medication administration, infection control, safety measures for pressure ulcer prevention, safety measures for falls prevention, management of pain, safety measures for intubated patients, and safety measures during transfer.

Scoring system:

The response to each item in the procedures was categorized into done correctly, done incorrectly, and not done. The total score for every checklist was calculated and converted into percent, then categorized as follows: Score (1) was for steps done correctly, and zero was for steps done incorrectly and not done. The total nurse's practice score was calculated and then converted to the mean percent score. The practice total score of nurses' responses points was 200 equal (100%); where a score from $\geq 80\%$ referred to adequate practice (equal ≥ 160 mark) and a score from $< 80\%$ referred to inadequate practice (equal < 160 mark).

B) For patients:

Tool III: Patients' safety outcomes checklist:

This assessment sheet was developed by Boyd, Wu & Stelfox, (2017) that modified by the researcher in the English language after reviewing the related literature. It comprised four parts:

Part 1: Personal characteristics data sheet that was developed by the investigator and includes patients' demographic

characteristics will include age, sex, medical history, diagnosis, and duration of admission.

Part 2: This part is concerned with assessed signs and symptoms of hospital-acquired infection. It consists of two parts:

1. General signs and symptoms of infection, and 2) Local signs and symptoms of infection

Part 3: This part is concerned with clinical risk assessment tools are specific assessments that are used to measure levels of risk for certain procedures and outcomes such as:

- a. **Braden scale** which was adopted from Braden et al., (1987) used to predict pressure sore risk. It is a summated rating scale composed of six subscales as follow; sensory perception, moisture, activity, mobility, nutrition, friction, and shear. The six subscales are ranked as follow; 1 (No risk) 2(Mild risk, 3(Moderate risk and 4 (Sever risk)
- b. **Fall's risk assessment** which was adapted from Morse, Black & Oberle (1989) used to predict the likelihood of a fall occurring and composed of six items as follow; history of falling, secondary diagnosis, ambulatory aid, iv/heparin lock, gait/transferring, and mental status. The six items are ranked as follow; 1(Low risk), 2(Moderate risk) and 3(High risk).
- c. **Critical pain assessment scale** or the Critical-Care Pain Observation Tool (CPOT) which was adopted by Gelinas, Fillion &Puntillo (2009) to assess unconsciousness and critically ill adult patients' behaviors indicators for pain. It is composed of four items as follow; facial expression, body movement, muscle tension, and compliance with a ventilator for intubated patients or vocalization for the extubated patient. Each item of CPOT scored from (0 to 3) with a total score of 12 it was divided.
- d. **Patients Safety Guidelines:** This guidelines were developed by the researcher in the form of an Arabic booklet after reviewing related literature (Elgazar, et al, 2019; Burns et al, 2019; Fleming & Martin 2018; Aboelfetoh et al., 2017; Lewis, et al, 2016) and included theoretical and practical parts that conclude knowledge about i.e., a definition of patients' safety, a definition of adverse events, causes of adverse events

and nurses' performance regarding safety measures about prevention of medication errors, prevention of infection, prevention of pressure ulcer, prevention of falls, management of pain, care of intubated patients and care during transfer.

Validity and reliability of tools:

The validity of the tools was ascertained by a group of five experts from the nursing administration department and medical surgical nursing department, faculty of Nursing, Cairo University and Ain-Shams university as follows; one Professor, 2 assistant professors, and 2 lecturers. Their opinions were elicited regarding the format, consistency, accuracy, and relevancy of the tools; necessary modification was done accordingly.

Reliability was tested statistically to assure that the tools are reliable before data collection. Testing the reliability of the developed tools was done through the Alpha Cronbach test. Alpha Cronbach's reliability analysis for nurses' knowledge about patient safety guidelines questionnaire, was 0.86. Alpha Cronbach's reliability analysis for nurses' Patient safety practices observational checklist was 0.91. Regarding the patients' safety outcomes checklist; Alpha Cronbach reliability analysis for the Clinical risk assessment tool was 0.79. Alpha Cronbach reliability analysis for the Critical pain assessment scale was 0.83.

Pilot study:

After the tools have been designed, they were tested through a pilot study and excluded from the result, which was done before embarking on the fieldwork to check the clarity and feasibility of the designed tools and to estimate the time needed to complete its items. It was carried out on 10% of nurses (6) who are working in the General surgery ICU to estimate the proper time required for answering the questionnaire and 10% of patients (6) who were admitted to General surgery ICU, according to the result of the pilot study. Some modification was performed as needed.

Ethical considerations:

Initial approvals were obtained from the scientific research ethics committee at the Faculty of Nursing, Cairo University before starting the study and approval of the Cairo university committee. Also, Permission was

obtained from the hospital administrators after explaining the nature of the work. The nature and aim of the current study had been explained to nurses and patients included in the study before data collection. Oral and written consent was obtained from nurses to participate in the study. The study's participants were given a chance to accept or refuse participation in the present study, and each participant was assured that his/her information will be confidentially utilized and utilized for the research purpose only.

Procedure:

To carry out the study; approval was obtained from the hospital and nursing directors of the selected ICUs. A letter was issued to them from the scientific research ethics committee at faculty of nursing - Cairo University, explaining the aim of the study to obtain permission and cooperation to conduct the study. The guidelines were designed based on an analysis of the actual needs assessment of the study's nurses by using the pre-constructed tools. The data collection was accomplished throughout the following phases:

I) Assessment phase:

This phase includes the following:

- An assessment of the actual needs of the studied nurses by using the pre-constructed tools.
- An assessment of working time that was suitable for the implementation of the educational sessions and didn't interfere with nurses' work.
- An assessment of the place that was suitable for presenting the sessions of the educational guidelines.
- An assessment of nurses' attendance and availability according to their schedule.
- An assessment needed equipment such as a laptop for presenting the sessions of the educational guidelines, and hard and soft copies of the guidelines content.

II) Implementation phase:

This phase was divided into two steps as follows; pre-test and application of the educational guidelines.

Step one of the implementation phases (pre-test):

- The researcher interviewed the nurses and explained the aim of the study. They were assured that the information collected

would be treated confidentially and would be used only for purpose of research.

- The nurses' knowledge about patient safety guidelines questionnaire was distributed to all respondents' nurses and the researcher was offered clarification whenever confusing questions arise. The average time of filling out the questionnaires were 35-45 minutes. This process took two weeks, starting from 1/9/2019 to 14/9/2019.
- The researcher was filling the nurses' patient safety practices observational checklist during the morning and afternoon shifts during actual nurses' work. Nurses were observed while providing care to the patient. Each nurse was observed one time. The observational checklist was completed by the researcher in 30 to 35 min for every nursing personnel. This process took one month, starting from 15/9/2019 to 14/10/2019. The pre-testing took about 45 days. The researcher was available 4 days a week on morning and afternoon shifts in the study area.

Step two of the implementation phase (application of the educational guidelines):

- This phase included the application of the educational guidelines. The content of the guidelines was designed consistent with the related literature and meet the nurses' needs and level of understanding.
- The educational patient safety guidelines consisted of (6) sessions that were repeated over 7 weeks to cover the entire target population. A Group of 2 to 3 nurses from each unit participated in one session according to their working schedule. One session was done every day in the morning shift and repeated in the afternoon shift. The program was accomplished after attending 6 sessions (3 sessions of theory and 3 sessions of practice). This phase started on 15/10/2019 and ended on 20/2/2020.
- A hard and soft copy of the educational guidelines about the patient safety were submitted to all nurses (study subject). All questions asked by the nurses' staff were answered by the researcher.

III) Evaluation phase:

- Evaluation of the educational guidelines was done using the pre-constructed tools to measure the change in the studied nurses'

performance regarding the patient safety goals.

- The researcher was distributing the pre-constructed tools to measure the knowledge assessment questionnaire was distributed to all respondents' nurses. The average time of filling out the questionnaires was 35-45 minutes. This process took two weeks, starting from 22/2/2020 to 10/3/2020.
- The researcher was filling the observational checklist during the morning and afternoon shifts during actual nurses' work. Nurses were observed while providing care to the patient. Each nurse was observed one time. The nurses' patient safety practices observational checklist was completed by the researcher in 30 to 35 min for every nursing personnel. This process took 45 days, starting from 22/2/2020 to 25/3/2020.

For patients:

The researcher assessed patients using a patients' safety outcomes checklist (utilizing three tools). The evaluation was performed on admission and after one week, this phase took 3 months.

Results:

Table (1): Reveals that, 53.3% of the studied nurses were in the age category 25- <35 years with the mean \pm SD 33.1 \pm 2.31, 67.7% were females and 86.7% were married. Concerning qualifications, 41.7% had technical nursing institutes and 58.3% were staff nurses. Regarding years of experience, 58.3% had experienced years from 5- <10 years, and 75% hadn't attended any training courses related to patient safety in ICU.

Table (2): Shows that the mean score of total knowledge was 61.5 \pm 15.20 pre-implementation of patient safety guidelines, which improved to 143.5 \pm 37.9 post-implementation of patient safety guidelines. With highly statistically significant differences among all items pre- and post- implementation of patient safety guidelines at ($p \leq 0.001$).

Table (3): Demonstrates that, the total mean score of nurse's practices was 79.7 \pm 23.5 pre- implementation of patient safety guidelines. However, post-implementation improved to 188.8 \pm 40.1. In addition, there

were highly statistically significant differences between all items pre & post-implementation of guidelines at $p < 0.001$.

Table (4): Shows that there is a highly significant positive correlation between total nurses' knowledge and their practice at pre- and post-implementation of patient safety guidelines where $p < 0.001$.

Table (5): This table showed that nurses' practice regarding patient outcomes post implementation of the guidelines between the study and control group there were improved in the length of patient stay from 6.13 % in the control group to in the control group with statistically significant relation. While regarding patient readmission it decreased from the control group 75% to 38,8% in the control group post implementation of the guidelines with a statically significant relation. In addition, regarding the patient cause of admission, it was decreased from 25 patients in the control group to 14 patients in the study group post implementation of the educational guidelines with a statically significant relation. Finally, there was no statistically significant relationship between age, gender, diagnosis, and Co-morbidity status.

Table (6): Clarifies that (40%, 40% respectively) of both the control and the study group were at moderate risk on admission with no significant difference between them. While after one week (26.7%, 50% respectively) of control and the study group were at mild risk with a highly statistically significant difference between both groups at $p \leq 0.001$.

Table (7): Clarifies that (50%, and 46.7% respectively) were at moderate risk on admission with no significant difference between them. While after one week (13.3%, and 20% respectively) were at low risk with a highly statistically significant difference between pre- and post-implementation at $p \leq 0.001$.

Table (8): Clarifies that (11.7%, and 13.3% respectively) had moderate pain on admission. While, after one week (8.3%, and 25% respectively) had mild pain with a highly statistically significant difference between pre- and post-implementation of patient safety guidelines at $p \leq 0.001$.

Table (1): Number and percentage distribution of the studied nurses according to their demographic characteristics (n=60)

Demographic characteristics	The studied
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	sample (n=60)	
	No.	%
Age (Year)		
< 25	10	16.7
25 - < 35	32	53.3
35 - < 45	15	25
45-55	3	5
Mean ±SD		33.1 ± 2.31
Gender		
Male	20	33.3
Female	40	67.7
Marital Status		
Single	8	13.3
Married	52	86.7
Position		
Staff Nurse.	35	58.3
Head Nurse	25	41.7
Qualification		
A high school diploma in nursing	10	16.7
A technical nursing institute	25	41.7
A bachelor's degree in nursing	20	33.3
Postgraduate studies	5	8.3
Experience years		
< 5	10	16.7
5 - < 10	35	58.3
10 - < 15	7	11.7
15-< 20	8	13.3
Mean ±SD		96.8 ± 3.90
Attended any training course related to the safety measures of critically ill patients		
Yes	15	25
No	45	75
If yes, when did you receive this training course (n=15)		
Less than one year	5	33.3
One year	3	20
Three years	7	46.7

Table (2): Comparison between total nurses' knowledge pre- and post-implementation of patient safety guidelines (n=60)

Safety knowledge	The studied sample (n=60)								Chi square test	
	Pre-implementation of patient safety guidelines				Post-implementation of patient safety guidelines				X ²	p-value
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	N	%	N	%	N	%	N	%		
Patient identification	26	43.3	34	56.7	54	90	6	10	41.55	.000**
Effective communication	24	40	36	60	52	86.7	8	13.3	36.87	.000**
Dealing with high-risk medications	18	30	42	70	50	83.3	10	16.7	40.58	.000**
Safe surgery	25	41.7	35	58.3	54	90	6	10	37.68	.000**
Infection control	13	21.7	47	78.3	56	93.3	4	6.7	37.78	.000**
Decreasing risk of patient falls	16	26.7	44	73.3	55	91.7	5	8.3	32.91	.000**
RRT	12	20	48	80	54	90	6	10	31.84	.000**
Patient privacy	14	23.3	46	76.7	50	83.3	10	16.7	36.78	.000**
Prevention of bed sores	16	26.7	44	73.3	50	83.3	10	16.7	37.08	.000**
Total	14	23.3	46	76.7	53	88.3	7	11.7	42.63	.000**
Mean SD	61.5±15.20				143.5±37.9					

(*) Statistically significant at $p \leq 0.05$. (**) highly statistically significant at $p \leq 0.001$.

Table (3): Comparison between total nurses' practice pre- and post-implementation of patient safety guidelines (n=60)

Safety cticeregarding pra	The studied sample (n=60)								Chi-square test	
	Pre-implementation of patient safety guidelines				Post-implementation of patient safety guidelines				X ²	p- value
	Adequate		Inadequate		Adequate		Inadequate			
	N	%	N	%	N	%	N	%		
Medication administration	30	50	30	50	52	86.7	8	13.3	34.32	.001**
Medication error reporting	15	25	45	75	48	80	12	20	37.36	.000**
Infection control	24	40	36	60	52	86.7	8	13.3	34.95	.000**
Pressure ulcer prevention	14	23.3	46	76.7	50	83.3	10	16.7	36.78	.000**
Fall prevention	25	41.7	35	58.3	50	83.3	10	16.7	29.30	.000**
Pain management	12	20	48	80	54	90	6	10	31.84	.000**
Care of intubated patient	20	33.3	40	66.7	55	91.7	5	8.3	28.51	.000**
Total	16	26.7	44	73.3	50	83.3	10	16.7	37.08	.000**
Mean SD	79.7±23.5				188.8±40.1					

(**) highly statistically significant at $p < 0.001$.

Table (4): Correlation between total nurses' knowledge and their practice pre- and post-implementation of patient safety guidelines (n=60).

Variables		Total nurses' practice	
		Pre	Post
Total nurses' knowledge	r	0.574	0.551
	p	.000**	.000**

**highly significant at $p < 0.001$.

Table (5): Distribution of patients about their outcomes in control and study groups according to their demographic characteristics (n=120)

Demographic characteristics	Control group (n=60)		Study group (n=60)		P value
Age: Mean ± SD	41.76 ± 5.89		42.95 ± 6.73		0.067
Gender:	No.	%	No.	%	0.059
Male	35	58.3	31	51.7	
Female	25	41.7	29	48.3	
Diagnosis:	No.	%	No.	%	0.060
Cardiac surgery	37	61.7	42	70	
Chest surgery	14	23.3	13	21.7	
Cardiac catheter	9	15	5	8.3	
Co-morbidity status	No.	%	No.	%	0.057
No	35	58.3	36	60	
DM	10	16.7	14	23.3	
Hypertension	7	11.7	3	5	
DM & Hypertension	8	13.3	7	11.7	
Length of stay (Mean ±SD)					
1st	6.06 ± 1.76		5.23 ± 2.13		0.041*
2nd	6.13 ± 1.98		3.10 ± 0.94		0.023*
Readmission	No.	%	No.	%	0.031*
Yes	45	75	23	38.3	
No	15	25	37	61.7	
Cause of readmission	No.	%	No.	%	0.045*
Infection	26	57.8	14	60.9	
Complications	4	8.9	0	0	
Other	15	33.3	9	39.1	

Table (6): Comparison between the studied patients regarding total Braden scale on admission and after one week (n=120).

Total Braden scale	Control group	Study group
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	(n=60)				(n=60)				Test of Sig.
	On admission		After one week		On admission		After one week		
	N	%	N	%	N	%	N	%	
No risk	8	13.3	10	16.7	4	6.7	14	23.3	X ² =12.12 P=.000**
Mild risk	12	20	16	26.7	14	23.3	30	50	
Moderate risk	24	40	22	36.7	24	40	12	20	
Severe risk	16	26.7	12	20	18	30	4	6.7	

X²: Chi-square p= p-value

** : Highly statistically significant at $p \leq 0.001$. No significant at $p > 0.05$.

Table (7): Comparison between the studied patients regarding total fall risk assessment on admission and after one week (n=120)

Total fall risk assessment	Control group (n=60)				Study group (n=60)				Test of Sig. (p ₂)
	On admission		After one week		On admission		After one week		
	N	%	N	%	N	%	N	%	
Low risk	12	20	8	13.3	20	33.3	12	20	X ² =.064 P=.000**
Moderate risk	30	50	12	20	28	46.7	11	36.7	
High risk	18	30	10	16.7	12	20	7	11.7	

X²: Chi-square p= p-value

** : Highly statistically significant at $p \leq 0.001$. No significant at $p > 0.05$.

Table (8): Comparison between the studied patients (control and study group) regarding total critical pain assessment scale on admission and after one week (n=120)

Total critical pain assessment scale	Control group (n=60)				Study group (n=60)				Test of Sig.
	On admission		After one week		On admission		After one Week		
	N	%	N	%	N	%	N	%	
No pain	7	11.7	5	8.3	8	13.3	15	25	X ² = 10.66 P=.003 **
Mild pain	8	13.3	12	20	12	20	30	50	
Moderate pain	25	41.7	30	50	30	50	11	18.3	
Severe pain	20	33.3	13	21.7	10	16.7	4	6.7	

t: t. test p= p-value

** : Highly statistically significant at $p \leq 0.001$. No significant at $p > 0.05$.

Discussion:

Patient safety is a major challenge for quality improvement and enhancing providers' and nurses' performance. The World Health Organization (WHO) is committed to making patient safety a high priority on the policy agenda of countries. The increasing incidence of documented cases of adverse events in healthcare has to a growing concern in several countries about patient safety, which remains a fundamental principle of patient care and a critical component of quality management (Sean, 2018).

Regarding the demographic characteristics of nurses, the findings of the present study revealed that more than half of

the studied nurses were in the age group between 25<=35 years old with a mean \pm SD (33.1 \pm 2.31); this may reflect the demanding nature of critical care unit service, so that older nurses may find it difficult to cope with the load of work required, and newly graduate preferred to work in the critical care units as they can acquire knowledge submission of up-to-date knowledge. This result is in line with Singh, Meyer, Thomas, (2019) who studied (the assessment of nurses' performance regarding the implementation of patient safety measures in intensive care units" which stated that nearly three-quarters of the respondents were aged between 20-30 years.

In the present study, two-thirds of the studied nurses were females. This may be due to the greatest fraction of the nurses in Egypt being females and maybe because the study of nursing at Egyptian universities was exclusive for females only until a few years ago. These findings are consistent with Cruz, (2018) who studied "nurses' performance regarding the neurological assessment in the neurological unit" and reported that three-quarters of the study subject were females. But it disagrees with Bryant, (2019) in their study about "Knowledge and practices of nurses regarding nosocomial infection control measures in private hospitals in Sana'a City, Yemen" which stated that the highest percentage of nurses were males (61.2%).

Concerning marital status, the result of the study reveals that the majority of the studied nurses were married. This finding is in agreement with, Falender, Ellis & Burnes, (2019) who reported that the majority of the studied nurses were married. From the researcher's point of view, this may be due to the studied nurses being in the age group known in Egypt that they married. Concerning qualification, the current study finding shows that less than half of the study nurses had technical nursing institute, this result disagrees with Edward & Milne, (2019) in his study entitled "assessment of patient safety culture among Egyptian healthcare employees" which showed that all ICU nurses had a bachelor's degree in nursing science.

Concerning years of experience, the current study finding showed that more than half of the studied nurses had 5-<10 years of experience, this explains that most of those nurses were newly graduated, young, and tolerated the nature of the work. This result is in agreement with Sean, (2018) study entitled "Knowledge and practice of intensive care nurses on prevention of ventilator-associated pneumonia at Muhimbili National Hospital" which found that more than two-thirds of nurses were working in ICU for less than 10 years.

Concerning past-training courses about patient safety, the result of the current study revealed that three-quarters of nurses had not attended any training courses related to patient

safety in ICU. The finding of the current study can be explained in light of the belief that lack of hospital financial resources for training or shortage of nursing staff and work overload which considered a barrier for nurses to leave work and attend a training course. This finding is in agreement with Richards, Brink & Messina, (2019) who conducted a study entitled "Effect of a training program on reduction of nurse's medication errors" and stated that few staff nurses attended training programs about medication administration.

Regarding total nurses' knowledge at pre- and post-implementation of patient safety guidelines. The current study result revealed that the mean score of total knowledge was increased post guidelines implementation than before. Also, there were highly statistically significant differences between all items of knowledge at $p \leq 0.001$. This result was in agreement with Abiddin, (2018) study titled "Patient safety culture among nurses" which found that majority of the study subjects' knowledge with improved post implementation of the program.

Regarding total nurses' practice at pre- and post-implementation of patient safety guidelines. The current study result revealed that the total mean score of all nurses' practices were improved post- guidelines implementation than pre-implementation with highly statistically significant differences between all practices pre- and post-implementation.

The previous result is supported by Aitken & Gorokhovich, (2019) who conducted their study to evaluate the effect of training on nurses' knowledge and skills and revealed that there was a highly statistically significant difference between levels of acquired nurses' practices pre/post the interactive training. Moreover, this finding is in agreement with Batalden & Davidoff, (2019) who concluded that there was a statistically significant difference between before and after an educational program for a patient on mechanical ventilation regarding total nurses' practice scores. Additionally, that adequate performance infection controls standard precautions, which increased after the application of education.

This result of the study is in the same line with the study done by Arditi & Gunaydin & Olcay, (2018) stated that there was a highly statistically significant difference in the nurse's practice in pre and post the training program as patient safety considerations are worth noting first. Patients receiving mechanical ventilation in ICU require continuous observation and monitoring

As regards nurse's practice regarding patient outcomes post- implementation of the patient safety guidelines between the study and control group there were improvements in length of patient stay from 6.13 % in the control group to 3.10 in the study group with a statistically significant relation. While regarding patient readmission it decreased from the control group three-quarter to less than two-fifths in the study group post-implementation of the guidelines with a statically significant relation. Finally, there was no statistically significant relationship between age, gender, diagnosis, and Co-morbidity status. This result was in agreement with Greiner, (2019), the study titled was " Patient Safety Culture Structures and Outcomes: A Sample from Isolation Units in Saudi Arabia" who found that there were positive significant correlations highlight staffing and non-punitive response to errors as key challenges for patient safe hospital care.

This result is consistent with Jain, Miller & Belt, (2019) who studied " The effect of implementing clinical alarm nursing intervention program on nurses' knowledge, practice and patient outcomes at intensive care unit " and reported that no statistically significant difference was found between the two groups in relation socio-demographic characteristics and medical characteristics It was observed that more than one-third of control and study group had an age between 40-<50 years.

Also, this finding is in agreement with Cruz, (2018) who study about "effect of implementing a protocol of nursing care on hemodialysis patients ' safety outcomes", and reported that the majority of the patients were in the age group 50 < 60. According to Greiner, (2019) reported that more than half of the

control and study groups in the age category were between 50-<60.

Regarding gender of the studied patients' groups, the current study revealed more than half of the studied patients (study and control group) were male. According to Greiner, (2019) reported that more than half of the studied patients in the control and study group were males.

Regarding the studied patients' diagnosis, also the current study revealed that more than one-quarter of control & study groups were diagnosed with a brain hemorrhage. This might be due to their suffering from hypertension which is the leading cause of brain hemorrhage & stroke. Also, the current study reveals that there was no statistical difference between the control & study groups regarding demographic data and medical history with $p > 0.05$ which indicated the two groups were nearly homogenous. This finding is in the line with Sean,(2018) who reported that more than one-quarter of the control & study group were diagnosed with brain hemorrhage and stroke.

Regarding the studied patients' comorbidity status, the current study revealed that two-fifths of the control group and one-third of the study group had hypertension. This might be due to two-fifths of the control and study group were in the age category 51>60 and at this age, most people in Egypt suffer from chronic diseases such as hypertension and diabetes mellitus also, these could be the most common diseases reported all over the world in both developed and developing countries. According to Sean,(2018) reported that more than one-quarter of studied patients in the control and study group had hypertension.

In concerning the comparison between the studied patients (control and study group) related to total Braden scale on admission and after one week. The current study clarified that two-fifth of both the control and study groups were at moderate risk on admission with no significant difference between them found. While after one week less than one-third and nearly half of the control and study group were at mild risk, respectively, with a highly statistically significant difference between both groups at $p \leq 0.001$. This finding is in the line with Sean,(2018) who reported that more than

one-third of the control and study group were at severe risk on admission, while after two weeks, around one-third and one-fourth of the study group were at moderate risk and mild risk, respectively.

This finding is in agreement with Sean, (2018) whose study indicated that there was a significant difference between the study and control groups on the 3rd day, and a highly significant difference on the 7th day related to risk assessment by the Braden scale was found. Also, this finding is in agreement with Singh, Meyer, & Thomas, (2019) whose study indicated that, on the day of admission, there was no significant difference between the study and control groups related to risk assessment was noted, but there was a significant difference at 2nd to 4th day. There was a moderate significant difference on the 5th to 6th day then there was a highly significant difference on the 7th day.

This finding is in the line with Sean, (2018) who reported that 80% of all patients were at risk for pressure ulcers based on the total score of the Braden scale pre-application of the program, while the lowest prevalence among patients was represented a 30% after implementing of programs.

Regarding total fall risk assessment for the studied patients on admission and after one week. The study clarifies that less than half of both the control and study groups were at moderate risk on admission with no significant difference between them. While after one week, one-fifth and two-fifth, respectively of the control and study group were at low risk with a highly statistically significant difference between both groups at $p \leq 0.001$.

This finding is in agreement with Slawomirski, Auraen, & Klazinga, (2018) who study about " Impact of nurses' intervention in the prevention of falls in hospitalized patients" and concluded that the systematic assessment of the risk of a patient falling during the hospital processes has proved to be an effective intervention to reduce the incidence of falls, especially in the elderly, who have the most falls. It is, therefore, necessary to implement specific advanced training for all nurses and not as a voluntary training program. There is a need to further improve the evidence

on clinical practices to ensure patient safety (such as fall risk prevention), especially with experimental studies.

Regarding the total critical pain assessment scale for the studied patients on admission and after one week. The study clarifies that half of both the control and study group had moderate pain on admission with no significant difference between them. While after one week fifth and one-third respectively of the control and study group had mild pain with a highly statistically significant difference between both groups at $p \leq 0.001$.

This result agrees with Härkänen, Tiainen & Haatainen, (2018) in their study entitled "The effectiveness of systematic pain assessment on critically ill patient outcomes: A randomized controlled trial" which stated that the incidence of pain according to the total critical pain assessment scale in the intervention group was significantly lower compared to the control group ($p < .001$). These findings are supporting the third research hypothesis.

The same line study done by Jha, (2018) entitled "Effect of Teaching Program on Critical Care Nurses' Performance About End-of-Life Care for Hepatic Patients" In their study showed that there was a relationship found between knowledge and practice score before and after the teaching program.

Conclusion:

In the light of the preceding present study results, it can be concluded that the total mean score of nurses' knowledge was improved after the implementation of nursing care guidelines than pre-implementation. The total mean score of nurses' practice improved after the implementation of nursing care guidelines than pre-implementation. There was a highly significant positive correlation between total nurses' knowledge and their practice at pre- and post-implementation of patient safety guidelines where $p < 0.001$. There was an improvement in patient safety outcomes for the study group than the control group after one week with a statistical significance difference.

Recommendation:

Based on the study results the following recommendations are suggested:

- To provide In-service education in the hospitals. This education aims to improve nurses' performance regarding patient safety measures. This improvement results from the acquisition of knowledge and the implementation of established standards of care taking into consideration that these standards should be periodical updated.
- To manage special training programs on how to apply International Patient Safety Goals for all health team members in the hospital.
- All nurses working in ICUs should complete regular periodic in-services training programs to keep them up to date regarding patients' safety culture.
- To provide orientation programs about ICUs patients' safety culture for newly enrolled staff nurses working in different critical health care settings.
- To established written guidelines regarding the intensive care patients' safety that should be available in all ICUs, and the patients should be closely monitored for potential errors
- To develop a standard nursing procedures booklets and be available in every intensive care unit in both Arabic and English language.

Related to future research:

A similar study should be replicated on a large sample and other places to generalize the findings.

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