ACTA SCIENTIAE

ISSN: 2178-7727
DOI: 10.17648/acta.scientiae.6369

EFFECT OF PATIENT SAFETY TRAINING ON KNOWLEDGE AND PRACTICE OF NURSES

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Abstract

Patient safety has become a priority in health policy and healthcare management. nurses play a vital role in improving the safety and quality of patient care in the hospital. Aim of the study: To assess the effect of patient safety training on knowledge and practice of nurses. Research design: A one-group pretest-posttest quasi-experimental design was used to carry out the study. Study setting: The study was conducted at critical and non-critical units in cardiovascular hospital affiliated to Ain Shams University hospitals. Study subjects: The subjects of the study were nurses working in the aforementioned setting during the time of the study. Data collection tools: Patient safety knowledge questionnaire and observational checklist of patient safety performance. Results: There was highest percentage of satisfactory knowledge for the patient safety (69.5%) at the pre-intervention phase, this rose to (100%) at the post- intervention phase and the follow-up phase still statistically significant in the nurse's knowledge as post intervention phase (100%). None of the nurse (zero%) had adequate performance related to patient safety goals at pre-intervention phase. This rose to (100%) at the post-intervention phase and declined to (87.8%) at follow up phase. The differences were statistically significant. Conclusion: The use of the developed training program is effective in improving their knowledge and practice related to patient safety goals. Recommendation: Implementing patient safety training program is highly recommended for nurses to improve patient safety knowledge and practices because it is positive effect and creating a collaborative work climate by hospital administration to share and exchange information about patient safety goals through implementing huddles.

Keywords: Knowledge, Nurses, Patient, Practice, Safety

Introduction:

Patient safety has become one of the main focuses of healthcare organizations worldwide over the last two decades. The production, dissemination, implementation of policies, strategies, and procedures have been adapted to reduce errors and ensure the safety and quality of the delivery of care. However, failures continue to occur despite the initiatives undertaken over the past twenty years. Therefore, it is highly recommended that health organizations foster a consistent safety culture with an integrated approach to managing adverse events (De Rezende & Melleiro, 2022).Every point in the process of care-giving contains a certain degree of inherent un safety. Many countries have published studies showing that significant numbers of patients are harmed during health care, either resulting in permanent injury, increased length of stay in health care facilities, or even death. Organizational leadership capacity, data to drive safety improvements, skilled health care professionals and effective

involvement of patients in their care are needed to ensure sustainable and significant improvement in the safety of health care setting **(Lee et al., 2023).**

Patient safety is defined as freedom from accidental or preventable injuries produced by medical care. And also "patient safety is a discipline in the healthcare sector that applies safety towards the goal of achieving a trustworthy system of health care delivery" **(Malak et al., 2022).** Patient safety is an attribute of health care system that minimize the incidence and impact of recovery from adverse events. PS also defined as the prevention of errors and adverse effects associated with health care of patients and the discipline of patient safety as "the coordinated effort to prevent harm, caused by the process of health care itself, from occurring to patients. **(Larasati & Dhamanti., 2021)**

The goal of patient safety is to prevent patient harm by having processes that identify and treat hazards before they lead to patient harm (pro-active), identify when patients are harmed and promptly intervene to minimize the harm as a result of the incident (reactive) and ensure that lessons learned from clinical incidents are applied through taking corrective actions designed to minimize the risk of similar incidents occurring in the future. **(Mamdouh et al., 2020)**

Nurses are a vital part of the healthcare delivery system, being in a unique position to make patient care as safe as possible. Nurses are committed professionals in a unique role to advocate for patient safety and contribute to the overall efforts to reform healthcare. Nurses are the largest group of healthcare providers in the nation and are regarded by the public as the most highly ethical and honest group of professionals. Thus, nurses and the nursing profession play a distinctive role in promoting positive change that will ultimately benefit patients **(Hadad et al., 2021).**

Significance of the study:

Patient safety is an essential and vital component of quality nursing care as they are responsible for ensuring that patient care is safely delivered and that no harm occurs to patients and nurses play a vital role in improving the safety and quality of patient care in the hospital, Nurses need to know what proven techniques and interventions they can use to enhance patient safety.

The researchers observed many nurses don't comply with patient safety goals due to lack of knowledge and practice on this issue, that lead to more incident reports about negative consequences on care delivered to the patient. Hence, this study was carried out to assess the effect of patient safety training on knowledge and practice of nurses.

Aim of the study:

This study was aimed at assessing the effect of patient safety training on knowledge and practice of nurses.

Research hypothesis:

Implementation of patient safety training would improve knowledge and practice of nurses.

Subjects and Methods:

Research Design:

A one-group pretest-posttest quasi-experimental design was used to carry out the study.

Research Setting:The study was conducted at critical and non-critical units in cardiovascular surgery hospital affiliated to Ain Shams University hospitals. It provides inpatient and outpatient services for cardiothoracic patients. Critical units were included in the study ten intensive care units with 65 beds (Emergency ICU, Adult cardiothoracic surgery ICU 1, Adult cardiothoracic surgery ICU 2, Adult cardiothoracic surgery ICU 3, Pediatric ICU, Chest ICU, Cardiac Care Unit (CCU1), Cardiac Care Unit (CCU2), Cardiac Care Unit (CCU3) and Post Cath ICU) and non-critical units include three inpatient departments with 86 beds.

Research Subject:

The subjects of the study were nurses working in the aforementioned setting during the time of the study. Their total number is (130), and the sample size was selected by simple random sample. The sample size was calculated to test for the difference between the expected rates of nurses' satisfactory knowledge and adequate practices related patient safety before (p1=50%) and after (p2=75%) implementation of the intervention. Using the Open Epi software program for sample size for the difference between two proportions, the required sample size is 66 nurses and increased to 82 to compensate for an expected dropout rate of around 20%.

Data collection tools:

Data were collected by using the following tools:

Tool 1: Patient Safety Knowledge Questionnaire: This tool consisted of two parts:

Part 1: Personal characteristics of the studied nurses

It aimed to collect personal characteristics of the studied nurses which include age, gender, name (optional), educational qualification, work department, experience, and previous training.

Part 2: patient safety knowledge questionnaire

It was developed by **(Abdel- Hamid, 2018)** and adopted by the researchers. It aimed to assess nurses' knowledge regarding six international patient safety goals. It consisted of (37) questions classified into (21) multiple-choice question and (16) true / false questions as definition of patient safety and questions related to six international patient safety goals. These goals were: (Goal One: Improve

the Accuracy of Patient Identification, Goal Two: Improve the Effectiveness of Communication among Caregivers, Goal Three: Improve the Safety of Using High-Alert Medications, Goal four: Eliminate Wrong-Site, Wrong-Patient, and Wrong- Procedure Surgery, Goal five: Reduce the Risk of Healthcare-Acquired Infections and Goal six: Reduce the Risk of Patient Harm Resulting from Falls)

Scoring system:

For each question, a correct response was scored 1 and the incorrect zero. For each area of knowledge, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into percent scores. Knowledge was considered satisfactory if the percent score was 60% or more and unsatisfactory if less than 60%. **(Abdel- Hamid, 2018)**

Tool 2: Observational Checklist of Patient Safety Performance: This tool consisted of two parts:

Part 1: A part for identification data of nurses which include code number, name of the unit, the time of observation and observation number

Part 2: It was developed by **(Abdel-Hamid, 2018)** and adopted by the researchers to assess the performance of international patient safety goals (IPSGs) by the nurses. It consisted of 83 items covering the steps of the IPSGs procedures to be performed by the nurses.

Scoring system:

The items observed "not done" and "done" were scored "0" and "1", respectively. For each task, the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the part. These scores were converted into percent scores. The performance was considered adequate if the percent score was 85% or more and inadequate if less than 85% given that patient safety is a critical issue in quality. **(Abdel- Hamid, 2018).**

II. Operational Design

This design involves a description of the preparatory phase, validity and reliability of the developed tools, pilot study, fieldwork and ethical considerations.

Preparatory Phase:

This phase lasted for two months on the beginning of September 2022 and ended in October 2022. In this phase, the researcher reviewed related past, current, local and international literature as well as theoretical knowledge of various aspects of the study using books, articles and the internet to develop and adapt data collection tools. Development and adoption of the tools were under supervisors' guidance and experts' opinions were considered.

Tools validity and reliability:

Tool Validity:

The preliminary form of the questionnaires was presented to a panel of experts for face and content validation, the jury panel consisted of five expert professors; 3 in nursing administration from the Faculty of Nursing – Ain Shams University and 2 experts in health care quality department from the Faculty of Medicine – Ain Shams University. The process involved their general and overall opinions about the form. Then, they assessed each item for clarity, comprehensiveness, simplicity, understanding, and applicability. Accordingly, to their opinions recommended modifications were performed by the researchers.

Face Validity:

It was tested through the jury group responses to statements regarding the general form of proposed tools by eliciting their opinions as agree in addition to comments column.

Content Validity:

Content validity was conducted to determine the appropriateness of each item to be included in the questionnaire sheet. The response was agree, disagree and comment based on the jury recommendation, corrections, and modifications of some items were done.

Tool Reliability:

Reliability for tools were done to test the internal consistency of the tools. Internal consistency reliability of all items of the tools was assessed using Cronbach's alpha coefficient. patient safety knowledge questionnaire (0.678) and observational checklist of patient safety Performance (0.949)

Ethical Considerations:

Before the actual fieldwork of the research study, the study protocol was approved by the research committee at the Faculty of Nursing, Ain-Shams University. The researchers met with the study subjects to explain the purpose of the study and a verbal consent was obtained from each participant before inclusion in the study sample. All the studied nurses were informed that participation in the study was voluntary; their names were voluntarily included in the questionnaire sheet. The anonymity and confidentiality of each participant was respected and protected, confidentiality was assured and subjects were informed that the content of the tool was used for research purpose only and they had the right to refuse to participate in the study or withdrawal at any time without any consequences.

Pilot Study:

A pilot study was conducted in November 2022. It was held on 10% of the main study sample representing (9 nurses). It aimed to test the study process & to determine the clarity and feasibility of the study tools, as well as estimate the time needed for filling the forms; Since no changes were done in the tools. All participants in the pilot study were included in the main study sample.

Fieldwork:

The actual field of the study lasted for 9 months from the beginning of December 2022 and ended in August 2023. It involved phases of assessment, planning, implementation and evaluation.

Assessment phase

This phase involved pre-testing of the study nurse's knowledge and practice using the relevant data collection tools. After obtaining final permission from the director of cardiovascular surgery hospital through letter from the Dean of Faculty of Nursing, Ain Shams University in November 2022, the researchers met with the nurses to discuss the aim of the study and to obtain their agreement to participate. After obtaining the verbal consent from nurses, they were handed the self-administered questionnaire form to assess their knowledge related to patient safety. This was done on-job during the morning shift from 9:00 pm. to 1:00 pm and the researchers were present during this process to clarify any questions and to prevent any knowledge contamination. Every nurse took approximately 25-30 minutes to answer the knowledge questionnaire. The filed forms were handed back to the researchers who checked them for completeness.

Then, observation checklist of patient safety performance was done by observed each nurse individually by the researcher during the morning shift from 9:00 pm. to 1:00 pm using the observation checklist of patient safety performance. Each nurse was observed three times. The period between successive observations were at least two days. The observation lasted 40 to 45 minutes for each nurse. The average of the three observations were used in the statistical analysis. This process took approximately one month conducted until the end of December 2022.

Planning phase

After completing the data collection in the assessment phase, analysis was done by the researchers in order to identify all strengths and weakness of nurses' knowledge and performance related to patient safety. It also involved all comments reported and recorded by the researchers. This process took approximately one month conducted until the end of January 2023. Based on the information obtained from analysis of the assessment phase data, the researchers developed the patient safety training program content, booklet and media used. The researchers also used pertinent literature in this process.

Implementation phase

The main objective of the training program was to improve nurses' knowledge and practice related to patient safety goals. Teaching methods used included on-job training mini lecture, small group discussion, participation in discussion and brainstorming for theoretical sessions. Teaching methods for practical sessions used included videos, movies, real situations, role play and demonstration -re-demonstration. The media used were videos, posters, forms and data presentation through group on Wathapp (Wathapp is a recognized and well-known method of communication and training within the hospital). During each training program session, the researchers discussed with nurses the strong and weak aspects regarding their performance related to patient safety. At the end of training program nurses were handled with the training program booklet. The theoretical and practical sessions were conducted during the morning shift from 9:00 pm. to 1:00 pm at least three days per week for two months from the beginning of February to the end of March 2023.

The training program consisted of six sessions; they were preceded by an opening & awareness session. these sessions were divided into (3) theoretical sessions and (3) practical sessions with total hours (12) for nurses, two hours per session. Sessions were divided into (6) hours for theoretical and (6) hours for practical sessions. The six sessions were as follows:

Session 1: concept of patient safety, patient identification and communication among caregivers.

Session 2: Patient identification and communication among caregivers (practical session)

Session 3: Safety medication and safe surgery.

Session 4: Safety medication and safe surgery (practical session).

Session 5: prevention of health care acquired infection and fall risks.

Session 6: Hand hygiene and fall prevention measures (practical session).

Evaluation phase

Immediately at the end of the last session of the program, the researchers collected the post-testing knowledge questionnaire from the study nurses to assess their knowledge related to patient safety after implementation of the training program immediately using the same knowledge questionnaire as in the assessment phase and by the same method was done as in the assessment phase.

After 2 weeks, each nurse was observed individually three times to assess practice related to patient safety using the same observational checklist as in the assessment phase. The period between successive observations were at least two days and the average of the three observations were used in the statistical analysis. This phase took about one month until the end of April 2023.

For follow up phase, three months after the completion of implementing the training program, the researchers evaluated the effect of the program on nurses' knowledge and practice related to patient safety. This also was done using the same data collection tools and observational checklist as in the assessment phase and by the same method was done as in the assessment phase. The nurses handed

the self-administered questionnaire form to assess their knowledge related to patient safety after three months from implementation of the training program.

For observational checklist, each nurse was observed three times to assess practice related to patient safety. The period between successive observations were at least two days and the average of the three observations were used in the statistical analysis. This phase took about one month until the end of August 2023.

Statistical Design:

Data entry and Statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 27. Data were presented using descriptive statistics in the form of frequencies and percentages for categorical data, the arithmetic mean (X) and standard deviation (SD) for quantitative data. Cronbach alpha coefficient was calculated to assess the reliability of the scales used through their internal consistency. Qualitative categorical variables were compared using the chi-square test (X2). Whenever the expected values in one or more of the cells in a 2×2 table were less than 5, the Fisher exact test was used instead. In larger than 2×2 cross-tables, no test could be applied whenever the expected value of 10% or more of the cells was less than 5. Spearman correlation was used for the assessment of the inter-relationships between quantitative variables and ranked ones. To identify the independent predictors of the score multiple linear regression analysis was used. Statistical significance was considered at p-value (< 0.05).

Significance of the results:

- Highly significant at p-value <0.01.
- Statistically significant was considered at p-value <0.05.
- Non-significant at p-value >0.05.

Results:

Table (1): demonstrated that, the study sample included 82 nurse whose age ranged between 22 and 56 years, with median (35.5) years. More than two-thirds of them were females (69. 5%) and (62.2 %) of them had diploma in nursing education. The great majority of them worked in critical care units (84.1%) with experience years ranged between 1 and 31 years, with median (10.0) years. Finally, more than two-thirds of them had training courses regarding patient safety goals in hospital (69.5%).

Table 2 shows that, the majority of nurses had satisfactory knowledge related to patient safety goals at the pre-intervention phase (69.5%). Statistically significant improvement was revealed at the post intervention phase in all aspects (P<0. 001). The follow-up phase still statistically significant in nurse knowledge as post intervention phase and significantly higher compared with the pre-intervention levels (P <0.001).

Table (3): demonstrates that, generally inadequate nurses' performance of the majority patient safety goals at pre-intervention phase. Except goal of improve the safety using of medication concerning reducing the like-hood of patient harm associated with the use of anticoagulant therapy

which demonstrates that all or almost all nurse performed at the study phases. However, majority of patient safety goals demonstrated statistically significant improvement at the post-intervention phase, with declines at the follow-up phase but still higher compared with the pre-intervention level. The differences were statistically significant (P <0.001).

Finally, **Table 3** demonstrates that, none of the nurse (zero%) had adequate performance at pre-intervention phase. This rose to 100% at the post- intervention phase and declined to 87.8% at follow up phase. The differences were statistically significant (P <0.001).

Table (4): illustrated that, statistically significant strong positive correlation among nurses between knowledge score and practice score of patient safety (r = 0.756).

Table (5): demonstrates that, the statistically significant independent positive predictors of nurse knowledge score were the study intervention, Bachelor nursing qualification and experience years. Conversely, age was a negative predictor. The model explains 91% of the variation in the knowledge score.

As regard patient safety practice score, **Table 6** demonstrates that, the statistically significant independent positive predictors of nurse for patient safety practice score were the study intervention and knowledge score. Conversely, female gender and Bachelor nursing qualification were a negative predictor. The model explains 97% of the variation in the practice score.

Table 1: Personal data of nurses in the study sample (n=82)

	Frequency	**Percent**
Age:		
<40	51	62.2
40+	31	37.8
Range	22-56	
Mean ± SD	36.1 ±9.4	
Median	35.5	
Gender:		
Male	25	30.5
Female	57	69.5
Nursing qualification:		
Nursing school diploma	17	20.7
Technical institute diploma	34	41.5
Bachelor	31	37.8
Nursing qualification:		
Diploma	51	62.2
Bachelor	31	37.8
Unit:		

Wards	13	15.9
ICU	53	64.6
CCU	16	19.5
Unit:		
Wards	13	15.9
Critical care	69	84.1
Experience years:		
<10	39	47.6
10+	39	52.4
Range	1-31	
Mean ± SD	11.7±9.0	
Median	10.0	
Had training courses:		
No	25	30.5
Yes	57	69.5

Table 2: Knowledge of patient safety goals among nurses throughout the study phases

Satisfactory Knowledge (60%+)	**Time**						**X^2 (pre-post) (p-value)**	**X^2 (pre-FU) (p-value)**
	Pre (n=82)		**Post (n=82)**		**FU (n=82)**			
	No.	**%**	**No.**	**%**	**No.**	**%**		
Safety	31	37.8	78	95.1	78	95.1	60.43 (<0.001*)	60.43 (<0.001*)
Goal 1	36	43.9	82	100.0	82	100.0	63.93 (<0.001*)	63.93 (<0.001*)
Goal 2	65	79.3	81	98.8	80	97.6	15.98 (<0.001*)	13.39 (<0.001*)
Goal 3	48	58.5	82	100.0	81	98.8	42.89 (<0.001*)	39.56 (<0.001*)
Goal 4	65	79.3	82	100.0	82	100.0	18.97 (<0.001*)	18.97 (<0.001*)
Goal 5	44	53.7	80	97.6	82	100.0	42.85 (<0.001*)	49.46 (<0.001*)
Goal 6	37	45.1	79	96.3	79	96.3	51.96 (<0.001*)	51.96 (<0.001*)
Total knowledge:								
Satisfactory (60%+)	57	69.5	82	100.0	82	100.0	29.50	29.50
Unsatisfactory (<60%)	25	30.5	0	0.0	0	0.0	(<0.001*)	(<0.001*)

(*) Statistically significant at p<0.05

Table 3: Total practice of patient safety goals among nurses throughout the study phases

Adequate Practice (85%+)	Time						X^2 (pre-post) (p-value)	X^2(pre-FU) (p-value)
	Pre (n=82)		Post (n=82)		FU (n=82)			
	No.	%	No.	%	No.	%		
Goal 1: Improve accuracy of patient identification:								
When Giving medication	2	2.4	82	100.0	67	81.7	156.19 (<0.001*)	105.71 (<0.001*)
When giving blood/ blood products	1	1.2	80	97.6	59	72.0	152.24 (<0.001*)	88.41 (<0.001*)
When taking blood/other specimens\	0	0.0	76	92.7	31	37.8	141.64 (<0.001*)	38.23 (<0.001*)
Total goal 1: Adequate Inadequate	0 82	0.0 100.0	82 0	100.0 0.0	62 20	75.6 24.4	164.00 (<0.001*)	99.69 (<0.001*)
Goal II: improve effectiveness of Communication among caregivers								
Adequate Inadequate	0 82	0.0 100.0	81 1	98.8 1.2	49 33	59.8 40.2	160.05 (<0.001*)	69.88 (<0.001*)
Goal III: improve the safety of using medication:								
Safety use of high alert medications	5	6.1	79	96.3	42	51.2	133.64 (<0.001*)	40.83 (<0.001*)
Reduce likelihood of patient harm associated with anticoagulants therapy	77	93.9	81	98.8	78	95.1	2.77 (0.10)	0.12 (0.73)
Medication reconciliation	0	0.0	78	95.1	21	25.6	148.74 (<0.001*)	24.08 (<0.001*)
Total goal III: Adequate Inadequate	0 82	0.0 100.0	82 0	100.0 0.0	50 32	61.0 39.0	164.00 (<0.001*)	71.93 (<0.001*)
Goal VI: Reduce risk of healthcare-acquired infections								
Comply with Hand hygiene guidelines	2	2.4	82	100.0	76	92.7	156.19 (<0.001*)	133.88 (<0.001*)
Practice to prevent central line blood stream infections	21	25.6	82	100.0	76	92.7	97.13 (<0.001*)	76.34 (<0.001*)
Implement evidence-based practice to prevent urinary tract infections	19	23.2	81	98.8	75	91.5	98.50 (<0.001*)	78.16 (<0.001*)

Total goal VI:								
Adequate	6	7.3	82	100.0	78	95.1	141.64	126.51
Inadequate	76	92.7	0	0.0	4	4.9	(<0.001*)	(<0.001*)
Goal V: reduce the risk of patient harm resulting from fall								
Adequate	10	12.2	82	100.0	52	63.4	128.35	45.75
Inadequate	72	87.8	0	0.0	30	36.3	(<0.001*)	(<0.001*)
Total practice:								
Adequate	0	0.0	82	100.0	72	87.8	164.00	128.35
Inadequate	82	100.0	0	0.0	10	12.2	(<0.001*)	(<0.001*)

Table 4: Correlation matrix of nurses overall scores of knowledge and practice of patient safety

	Spearman's rank correlation coefficient	
	Knowledge score	Practice score
Knowledge score	1.000	
Practice score	.756**	1.000

(**) Statistically significant at p<0.01

Table 5: Best fitting multiple linear regression model for the knowledge score

	Unstandardized Coefficients		**Standardized Coefficients**	**t-test**	**p-value**	**95% Confidence Interval for B**	
	B	**Std. Error**				**Lower**	**Upper**
Constant	37.61	3.23		11.652	<0.001	31.24	43.99
Intervention	32.10	0.83	0.95	38.713	<0.001	30.47	33.74
Age	-0.31	0.12	-0.17	-2.523	0.013	-0.55	-0.07
Bachelor	2.34	1.02	0.07	2.303	0.023	0.33	4.36
Experience years	0.38	0.14	0.20	2.798	0.006	0.11	0.66

r-square=0.91 Model ANOVA: F=376.94, p<0.001

Variables entered and excluded: age, gender, unit, courses

Table 6: Best fitting multiple linear regression model for the practice score

	Unstandardized Coefficients		**Standardized Coefficients**	**t-test**	**p-value**	**95% Confidence Interval for B**	
	B	**Std. Error**				**Lower**	**Upper**
Constant	36.17	1.21		29.948	<0.001	33.78	38.55
Intervention	17.17	1.00	0.80	17.096	<0.001	15.19	19.15
Female gender	-0.87	0.36	-0.04	-2.440	0.016	-1.57	-0.17
Bachelor	-0.80	0.34	-0.04	-2.349	0.020	-1.47	-0.13
Knowledge score	0.12	0.03	0.19	4.097	<0.001	0.06	0.18

r-square=0.97

Model ANOVA: F=1109.56, p<0.001

Variables entered and excluded: age, experience years, unit, courses

Discussion

As regards personal characteristics of the studied nurses, the current study results revealed that less than two thirds of studied nurses aged less than forty years and more than two-thirds of them were females. These results may be due to the fact that the greater fraction of

nurses in Egypt is female and may also be related to the fact that studying of nursing in Egyptian universities were exclusive for females only till few years ago. Similarly, **(Abu Hussein et al., 2022)** revealed that slightly more than half of nurses had age ranging between twenty-one to thirty-one years old. Also, noticed that the majority of nurses' gender were females.

Concerning educational level, the current study findings revealed that, less than two-thirds of them had nursing diploma. About the studied nurses` working units, the majority of them worked in critical care units. Regarding their experience, they had nursing experience ranging between one and thirty-one years. on the same direction the study conducted by **(Desouky et al., 2021)** entitled "challenges facing staff nurses to maintain patient safety" demonstrated that the studied staff nurses had years of experience ranged between one to more than thirty years.

Finally, more than two-thirds of them had training courses regarding patient safety goals in hospital. The finding of the current study can be explained in the light of the belief that the hospital seeks accreditation, it is therefore interested in training all employees on these standard due to the importance of patient safety and risk assessment standards within the accreditation standards.

Regarding to the knowledge of nurses related to patient safety goals, the current findings documented that there were highest percentage of satisfactory knowledge related to patient safety goals at the pre-intervention phases. Additionally, a statistically significant improvement was revealed at the post-intervention phase in all aspects. The follow-up phase still statistically significant in nurse knowledge as post intervention phase and significantly higher compared with the pre-intervention levels. This is certainly due to the positive effect of the intervention on nurses' knowledge and safety performance, commitment to attend training courses and interacting with teaching methods of the program.

Similarly, the study conducted by **(Mahmoud et al., 2022)** entitled "Effect of Implementing Nursing Care Protocol on Critical Patient Safety Outcomes "clarified that the post mean knowledge score of nurse's regard patient safety post nursing care protocol implementation were higher than pre implementation.

On the opposite site, the findings in a study conducted by **(Hamed et al., 2023)** entitled "Assessment of Staff Nurses Performance Related to Patient Safety Goals "showed unharmony with the current results at which results demonstrated that only slightly more than one-third of the staff nurses had satisfactory knowledge related to patient safety goals in the assessment phase. Furthermore, the current study findings un similarly with, **(Biresaw et al., 2020)** who revealed that less than half of

nurses had satisfactory knowledge about patient safety before implementation of the training program. These differences could be attributed to variations in samples and settings.

Concerning nurse's performance regarding total practice of patient safety goals, the current study showed that generally inadequate nurses performance related to patient safety goals at the pre-intervention phase. Except for the goal of improving the safety using of medication by reducing the like-hood of patient harm associated with the use of anticoagulant therapy which demonstrates that all or almost all nurse performed this measure at the three study phases. From my point of view, this is a result of the great importance of the anticoagulant therapy for cardiovascular patients. They are among the priorities of nursing training for nurses at the beginning of their work, as they represent a matter of life and death for the cardiovascular patients. However, the majority of studied nurses shows a statistically significant improvement at the post-intervention phase in patient safety goals implementation, with slightly decline at the follow-up phase but still higher compared with the pre-intervention level. These were influenced by their age, gender, education and the training hospital.

Similarly **(Abd El Hamid, & Fakhry, 2022)** found inadequate performance of patient safety practice at the pre intervention phase. The use of the developed patient safety training bundle is effective in improving their patient safety performance.

In agreement with the current study, **(Alwhab et al., 2024)** found that two fifth of nurses had adequate level of practice pre implementation of educational program and more than three quarter of them had adequate level of practice post implementation of educational program.

As regard correlation between knowledge and practice score among nurses, the study findings represented a statistically significant strong positive correlation among nurses between knowledge score and practice score of patient safety.

Perhaps these finding because of the individual factors such as nurses' attitudes, perceptions, knowledge, and information seeking can facilitate or hinder the use of clinical practice guidelines by nurses and consequently endanger patient safety through inconsistent adherence to patient-safety principles and In accordance with the current study findings, **(Mamdouh et al., 2020)** showed a positive significant correlation between total knowledge and total performance of the nurses under the study regarding implementation of patient safety measures in intensive care units.

In the same direction, the findings of the review conducted by **Vaismoradi et al., 2020** highlighted that nurses' knowledge, perceptions, and attitudes influenced their adherence to patient-safety principles.

As regard knowledge score, the study findings demonstrated that the statistically significant independent positive predictors of nurses' knowledge score were the study intervention, Bachelor nursing qualification and experience years. Conversely, age was a negative predictor. The model explains vast majority of the variation in the knowledge score were related to these three variables.

Similar findings in a study conducted by **(Alwhab et al., 2024)** showed that there was a highly statistically significant relation regarding nurses' total level of knowledge and attending training course

post implementation of education program. Moreover, there was a statistically significant relation between nurses' total level of knowledge and educational level, experience and position post implementation of education program.

In the opposite side, the study conducted by **(Huh & Shin, 2021)** found that nurses' age was found a positive effect on patient safety knowledge and activities, presumably due to the fact that younger nurses have less experience than older nurses, which is associated with weaker decision-making authority and work autonomy, as reported by a study with tertiary hospital nurses.

As regard practice score, the study finding demonstrated that the statistically significant independent positive predictors of nurses practice score for patient safety were the study intervention and knowledge score. This is certainly due to the positive effect of the intervention on nurses' knowledge and safety performance. Conversely, female gender and Bachelor nursing qualification were a negative predictor. Similarly, **(Abdalla et al., 2023)** found that nurses' knowledge, perceptions, and attitudes influenced their adherence to patient-safety practice. On the opposite site**, (Mamdouh et al., 2020)** showed that there was high statistically significant relation between the nurses' practice and their qualification.

Conclusion

Based on the findings of the current study, it is concluded that the majority for practice of patient safety demonstrated statistically significant improvement after the use of the developed training program. Also, there is statistically significant strong positive correlation among nurses between knowledge score and practice of patient safety score. The use of the developed training program is effective in improving their knowledge and practice related to patient safety goals. Intervention and knowledge score were identified as positive predictors of nurses practice score as presented by best fitting multiple liner regression model. Thus, the set research hypothesis can be accepted and the training program can be used for this purpose.

Recommendations:

In the light of the findings of the current study the following recommendations can be suggested:

Hospital administration

- Implementing patient safety training program is highly recommended for nurses to improve patient safety knowledge and practices because it is positive effect.
- Creating a collaborative work climate by hospital administration to share and exchange information related to patient safety goals through implementing huddles.

Education

- Patient safety should be an integral part of the under graduate curriculum to improve patient safety knowledge and practice for students.

Further research study

- Follow-up and evaluate the long-term persistence of positive impact of patient safety training program on nurses practice revealed on the present study.
- Conduct study about challenges facing nurses to maintain patient safety goals practice with increasing sample and at different setting.

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