

Implementation of (Plan-Do-Check-Act) Process of Quality and Measuring its Effect on Nurses' Practice of Patient Safety Goals

Motiaa. F. Seliem, Prof. Dr/ Mona. M. Shazly, Assist. Prof/ Hemat. A. Mostafa
Nursing Administration Department – Faculty of Nursing, Ain Shams University

Abstract

Background: Implementing PDCA (plan- do- check – act) management can improve patient safety and satisfaction. Head nurse should create and maintain their safety management to increase the quality of nursing practices regarding patient safety goals practice. **The aim** of the study was to investigate the effect of head nurses' and staff nurses' use of PDCA on their patient safety practices. **Design:** One group pre-post assessment is used to carry out this study. **Subjects:** Two study subjects – head and staff nurses'. **Setting:** The study was conducted at inpatient units in Nasser institute hospital, which affiliated to Specialized Medical Centers of ministry of health. **Tools of data collection:** four tools were used for collecting data. Namely: Patient safety and PDCA knowledge questionnaire for head nurses and staff nurses, Observation checklist for performance of PDCA process related to patient safety goals for head nurses and staff nurses. **Result:** head nurses': all head nurses had low satisfaction with patient safety .both before and after the intervention. none of the head nurses had total adequate practice of PDCA before the intervention, which increased to 86.7% after the intervention ($p < 0.001$). The intervention, was a significant positive predictor of the practice scores, whereas age, experience in current department, and attendance of infection control courses were negative predictors. Staff nurses: none of the " staff nurses had satisfactory knowledge of patient safety before the intervention, compared to after the intervention ($p < 0.001$). No staff nurse had adequate practice of PDCA "before the Intervention, compared to after the intervention ($p < 0.001$). **Conclusion:** both head nurses and staff nurses in the study setting had deficient knowledge and practice of PDCA as applied to patient safety goals. **Recommendations:** The PDCA quality improvement cycle should be implemented in patient safety as well as in various areas of patient care. The training program should be applied to all head and staff nurses in the study setting, and should be extended to other similar setting. Creating and sustaining a culture of quality improvement by using PDCA cycle.

Key words: PDCA, patient safety goals, head and staff nurses.

Introduction

Quality in healthcare has been defined in many ways. "Quality" in healthcare is defined as everything the healthcare organization undertakes to fulfill the needs of its customer, be it the

patient, the payer, the admitting doctor, the employer, or an internal customer within the organization. **PDCA** Application of the PDCA cycle more effective than adopting the right first time approach. Using of the PDCA cycle means continuously looking for better

methods of improvement. The PDCA cycle is effective in doing a job and managing a program. The PDCA cycle enables two types of corrective action – temporary and permanent (**Sokovic, Pavletic, & Pipan, 2010**).

Then explained the mode steps as follows: **Plan.** In the PDCA cycle, planning is the first step. Planning requires processes to identify hazards, risks and shortcomings in a patient safety management system, and establish and implement plans for improvement. **Do.** This phase involves several activities, such as generating possible solutions, selecting the best of these solutions, and perhaps using techniques like impact analysis to scrutinize them. **Check:** In this phase, head nurses verify whether processes achieved desired results and effectiveness of the "do" step. Verifying could mean any form of monitoring or measurement of the activity. **Act.** If there are discrepancies found between what was planned and what was done, head nurses need to analyze the cause and act to improve the situation (**Yuswardi, 2013**).

The most common methods used for measuring patient safety are retrospective medical chart review, incident reporting systems, automated surveillance, and administrative or claims data. Retrospective medical chart review remains the "gold standard" for identifying adverse events. Although medical records contain detailed clinical information on patients, and often contain information about the safety events and the circumstances surrounding it, using them to systematically detect and measure safety events is not practical. Medical record reviews, particularly when the records are paper based rather than electronic, are costly, labor-intensive, and typically involve one or more clinicians (**Yuswardi, 2013**).

Patient safety widely used definition of patient safety is provided by the WHO, in which patient safety is defined as the absence of preventable harm to a patient during the process of health care (**World Health Organization [WHO], 2009**)

Patient safety is not only the task of individual nurses but it is also the responsibility of the head nurse as a leader in their ward. The head nurse performs as a manager in the ward and has a duty toward improving patient safety. Leadership and management are the organizational components to enhance patient safety (**IOM 2004**). Meanwhile, in some cases, nurses occasionally make mistakes because systems, tasks and processes are poorly designed (**Leape et al., 2002**).

Patient safety goals as a condition to be applied in all hospitals are accredited by the Commission on Accreditation of Hospitals. **Joint Commission International (JCI, 2011)** published international patient safety goals consisting of 6 key items, (Identify Patients Correctly, Improve Effective Communication, Improve the Safety of High-Alert Medications, Ensure Correct-Site, Correct-Procedure, Correct-Patient, Reduce the Risk of Health Care–Associated Infections - Reduce the Risk of Patient Harm Resulting from Falls).

Head nurses are responsible for ensuring all staff nurses within their sphere of responsibility are aware of policy, protocol and procedure to identify patients correctly. They are responsible for investigating all incidents of patients' misidentification, ensuring action to prevent recurrence are implemented (**Lucas, 2010**).

Nurses are an important part of the healthcare system and can improve

patient safety. In nursing, the term "patient safety" shows how nurses understand safety, as well as what is necessary to be done to ensure safety for patients and the efforts to improve it (*Yuswardi, 2013*).

Head nurses should put the safety policy into practice through careful planning of the safely activities. Planning means determination of the safety objective, priorities, indicator and preparation of working program to achieve the goals. Each ward can have different objectives and priorities according to the each national patient safety goals. In order to provide safety in practice, head nurses delegate some duties to representative nurse; a representative is elected from among nurses who have knowledge and experience in patient safety (*JCI, 2011*).

Significance of the study

Nurses comprise the largest group of professionals within the healthcare workforce and provide 75% of the care received by patients in hospital settings. There is an increasing demand for healthcare and nursing services due to population growth and, more significantly, due to the increasing proportion of people over the age of 65. At the same time, the supply of nurses is diminishing. This shortage would have a negative impact on patient safety. Enhancing head nurses' competencies in leading their teams towards application of patient safety goals through a systematic methodology as "Plan-Do-Check-Act" may help to overcome this negative impact.

Aim of the study

The aim of this study is to investigate the effect of head nurses' and staff nurses' use of PDCA on their practice of patient safety goals through:

1. Assessing head nurses' and staff nurses' knowledge of PDCA and patient safety goals.
2. Assessing head nurses' and staff nurses' practice of PDCA and patient safety goals.
3. Conducting a training strategy to use PDCA process of quality.
4. Measuring the effect of implementing PDCA on nurses' practice of patient safety goals.

Research hypothesis:

There is an improvement on nurses' practice of patient safety goals after implementation of PDCA process of quality?

Research design:

A quasi-experimental one group with pre-post assessment was utilized in conducting the study.

Setting:-

The study was conducted in the inpatient units at Nasser Institute Hospital. This hospital is affiliated to the Specialized Medical Centers of the Ministry of Health. It is concerned with providing inpatient and outpatient services to all categories of the community. The hospital consists of 800 beds in two separate buildings. The first 8-floor building includes all the inpatient

services and the second building includes all oncology outpatient services, inpatient one-day chemotherapy, and pain management clinics.

Subjects:-

The study subjects consisted of two groups, namely head nurses and staff nurses.

- 1- Head nurses group: All the head nurses working in the above-mentioned settings was included in the study. Their total number is 30 head nurses.
- 2- Staff nurses group: total number of staff nurses was participated in the study (n= 50 staff nurses) this number according to criteria for inclusion in the main study sample (experience more than one year working in the current department and work full time).

Tools of data collection:-

Four tools was used to collect data for this study, namely Patient safety and PDCA knowledge questionnaire for head nurses and Patient safety and PDCA knowledge questionnaire staff nurses, Observation checklist for performance of PDCA process related to patient safety goals for head nurses and Observation checklist for performance of PDCA process related to patient safety goals staff nurses.

Tool 1

Patient safety and PDCA knowledge questionnaire. This tool was prepared to assess head nurse pre-post knowledge about patient safety goals and PDCA cycle .this tool designed by the researcher based on (*Yuswardi, 2013*). It was comprised two parts:

First Part: This part is intended to the head nurse's socio-demographic data such as age, gender, qualification, experience (total and in management), marital status, etc.

Second part: This part is intended to assess head nurses' pre-post knowledge about Patient safety goals that consisting of 6 key items, 1) Identify Patients Correctly, 2) Improve Effectiveness of Communication, 3) Improve the Safety of High-Alert Medications, 4) Ensure Correct-Site, Correct-Procedure, Correct-Patient, 5) Reduce the Risk of Health Care–Associated Infections and 6) Reduce the Risk of Patient Harm Resulting from Falls, and PDCA process that included four-step improvement process that begins with planning the intervention, implementing the change, measuring results, and using the result to plan further improvements in the system.

Tool 2

Patient safety and PDCA knowledge questionnaire. This tool was prepared to assess staff nurses' pre-post knowledge about patient safety goals and PDCA cycle by the researcher (*Yuswardi, 2013*). It was comprised two parts:

First Part: This part is intended to the staff nurses' socio-demographic data such as age, gender, qualification, experience, marital status, etc.

Second part: This part is intended to assess staff nurses' pre-post knowledge about Patient safety goals that consisting of 6 key items, 1) Identify Patients Correctly, 2) Improve Effectiveness of Communication, 3) Improve the Safety of High-Alert Medications, 4) Ensure Correct-Site, Correct-Procedure, Correct-Patient, 5) Reduce the Risk of Health Care–Associated Infections and 6) Reduce the Risk of Patient Harm

Resulting from Falls, and PDCA process that included four-step improvement process that begins with planning the intervention, implementing the change, measuring results, and using the result to plan further improvements in the system.

Tool 3

Observation checklist for performance of PDCA cycle related to patient safety goals. This tool was developed by the researcher based on (Yuswardi, 2013 & JCI 2011) to assess head nurses' performance of PDCA cycle related to patient safety six goals before and after the intervention. It was comprised of two parts:

First part: This part is intended to the head nurse's socio-demographic data such as age, gender, qualification, experience (total and in management), marital status, etc.

Second part: This part intended to assess head nurses performance of PDCA cycle related to patient safety goals before and after intervention. Every patient safety goal was observed through PDCA cycle such as "Identify patient correctly" planning: is the head nurse informs the goal of ensuring identify patient correctly based on hospital standard. Doing: is the head nurse explain to all nurses to identify the patient correctly by asking the patient to name (first name and surname or father's name) and medical number. Checking: is the head nurse Check the patient's medical record and nursing needs based on identifiers from the initial assessments. Acting: is the head nurse investigate all of patient misidentification, ensuring actions to prevent reoccurrence are implemented.

Tool 4

Observation checklist for performance of PDCA cycle related to patient safety goals. This tool was developed by the researcher based on *ISOUA*, (2010) and *WHO* (2007) to assess staff nurses' performance of PDCA cycle related to patient safety six goals before and after the intervention. It was comprised two parts:

First part: This part is intended to the staff nurse's socio-demographic data such as age, gender, qualification, experience, marital status, etc.

Second part: This part will be consist of three sections based on *ISOUA*, (2010) and *WHO* (2007) solution of patient safety that include (general solution- medication management solution- surgical solution) and PDCA cycle.

➤ Scoring system

In the observation checklist, the items "not done" and "done" were scored "zero" and "1" respectively. The practice was considered adequate if the percent score was 60% or more and inadequate if less than 60%

Ethical considerations:

The researcher was clarified the aim of the study to the head and staff nurses to be included in the study. They were assured that anonymity and confidentiality would be guaranteed, and was informed about their right to refuse or withdraw from the study at any time. The study procedures do not entail any harmful effects on participants.

Preparatory phase:

This stage started from August 2016 till February 2017 It took 6 months; the researcher reviewed the national and international related literature concerning the topic of the study and developed the study tools .Tools were validated by jury group which consists of, two professors of nursing faculty from Cairo university, three doctors worked as quality consultant, and two pharmacist worked as quality consultant. The necessary modifications of the tools were done based on jury opinion.

Pilot study:

A pilot study was carried out on a sample of (3) head and (5) staff nurses from another setting representing about 10% of study sample. The aim is to test the clarity and applicability of the tools and the time needed for filling them in. Necessary modifications were done according to the results of the pilot study. The reliability of the tools was tested at this phase as applicable. The reliability of the practice checklists was assessed using Guttman split-half method. The analysis demonstrated very high reliability for the head nurse form, with coefficient 0.94. For staff nurse form, the reliability was just acceptable with a coefficient 0.50.

Field Work:

Data collection of the study was started at the beginning of March 2017, and completed by the 15th of June 2017 through four phases:

Assessment Phase: up on securing all permission to conduct the study. The data was collected during this phase constituted the pretest or baseline for the study.

Planning Phase: during this phase the researcher was analyzed the data collected to identify the knowledge deficiencies and gap between head and staff nurses, which considered during developing the training program.

Implementation Phase: The researcher divided the head and staff nurses into small groups according to availability and workload for conducting the training. Each group had two sessions on Saturdays and Thursdays, and one session on the other days of the week. The duration of each session was two hours. The program sessions were from 8:00 am to 10:00 am and from 10:00 am to 12:00 pm. This program was divided into two parts, one for head nurses and another one for staff nurses. For head nurses, each subgroup had 20 hours training (13 theoretical and 7 practical). For staff nurses, each subgroup had 18 hours (12 theoretical and 4 practical). The program was implemented throughout one and half month, from April first to March 15 2017. They were divided into subgroups. Each subgroup was given two sessions per week. Sessions included group discussions, mini-lectures, and actual practice.

Evaluation phase: after completion of the training program, the effectiveness of the program was assessed through posttest for knowledge and practice of head and staff nurses.

Statistical Design:

Data entry and statistical analysis were done using SPSS 20.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Qualitative categorical variables were compared using chi-square

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test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. Chi-square for trend was used to assess the statistical significance of trends of scales. Pearson correlation analysis was used for assessment of the inter-

relationships among quantitative variables, and Spearman rank correlation for ranked ones. Statistical significance was considered at p-value <0.05.

Result

Table (1): Demographic characteristics of head nurses in the study sample (n=30)

	Frequency	Percent
Age:		
<40	16	53.3
40+	14	46.7
Range	29.0-57.0	
Median	38.5	
Nursing qualification:		
Diploma	11	36.7
Bachelor	19	63.3
Experience years (total):		
<20	17	56.7
20+	13	43.3
Range	6.0-40.0	
Median	15.5	
Experience years (current dept.):		
<5	14	46.7
5+	16	53.3
Range	1.0-35.0	
Median	5.0	
Experience years (current position):		
<10	12	40.0
10+	18	60.0
Range	3.0-35.0	
Median	14.5	
Attended training courses in:		
Infection control	21	70.0
Patient safety	12	40.0
Quality	1	3.3
Total courses attended:		
Range	0-3	
Median	1.0	

Table (1): The head nurses in the study sample were all females whose age ranged between 29 and 27 years, median 38.5. Their medians years of total, current department, and current position experience were 15.5, 5.0, and 14.5 respectively. Slightly more than two-thirds of them had previously attended training courses in infection control (70.0%), while only one (3.3%) had training in quality.

Table (2): Satisfaction with knowledge of patient safety goals as reported by head nurses before and after the intervention

Patient safety areas:	Satisfaction with patient safety (max=2)				Mann Whiney Test	p-value
	Pre (n=50)		Post (n=50)			
	Mean±SD	Median	Mean±SD	Median		
Patient identification	1.1±0.4	1.00	0.8±0.6	1.00	5.48	0.02*
Effective communication	1.1±0.4	1.00	1.0±0.4	1.00	1.57	0.21
Medication errors	1.1±0.4	1.00	1.0±0.4	1.00	1.00	0.32
Surgical errors	1.1±0.4	1.00	0.9±0.5	1.00	2.26	0.13
Nosocomial infections	1.1±0.4	1.00	1.0±0.3	1.00	1.27	0.26
Bed sores	0.9±0.5	1.00	0.5±0.6	0.00	8.37	0.004*
Patient fall	0.9±0.6	1.00	0.3±0.5	0.00	12.33	<0.001*
Total	51.4±19.9	50.00	38.8±18.8	35.70	12.06	0.001*
satisfaction(max=100))						

(*) Statistically significant at $p < 0.05$

Table (2): illustrated the scores of head nurses' satisfaction with patient safety were low before the intervention, and even decreased after the intervention. The decreases were statistically significant regarding patient identification ($p=0.02$), bed sores ($p=0.004$) and patient fall ($p < 0.001$). In total, the total score of satisfaction decreased from 51.4 to 38.81 from a maximum of 100 ($P=0.001$).

Table (3): Total practice of PDCA in patient safety goals among head nurses before and after the intervention

Practice of PDCA in:	Time				X ² test	p-value
	Pre (n=30)		Post (n=30)			
	No	%	No	%		
Identify patient correctly:						
Adequate (60%+)	0	0.0	23	76.7	37.30	<0.001*
Inadequate (<60%)	30	100.0	7	23.3		
Effective communication:						
Adequate (60%+)	0	0.0	27	90.0	49.09	<0.001*
Inadequate (<60%)	30	100.0	3	10.0		
High alert medications:						
Adequate (60%+)	0	0.0	19	63.3	27.80	<0.001*
Inadequate (<60%)	30	100.0	11	36.7		
Correct procedures:						
Adequate (60%+)	0	0.0	27	0.0	55.00	<0.001*
Inadequate (<60%)	28	100.0	0	100.0		
Nosocomial-infections reduction:						
Adequate (60%+)	0	0.0	27	90.0	49.09	<0.001*
Inadequate (<60%)	30	100.0	3	10.0		
Fall risk reduction:						
Adequate (60%+)	0	0.0	28	93.3	25.50	<0.001*
Inadequate (<60%)	30	100.0	2	6.7		

(*) Statistically significant at $p < 0.05$

Table (3): indicates statistically significant improvements in all areas of practice of PDCA among head nurses' after implementation of the intervention ($p < 0.001$). The percentages of head nurses with adequate practice ranged between 63.3% for high alert medications, to 100.0% for correct procedures.

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Table (4): Correlation between head nurses' knowledge and practice scores and their characteristics

	Spearman's rank correlation coefficient					
	Pre (n=30)		Post (n=30)		Total (n=60)	
	Knowledge	Practice	Knowledge	Practice	Knowledge	Practice
Practice	-.090		.577**		.812**	
Age	-.127	-.260	.381*	-.229	-.127	-.122
Qualification	.112	.212	.313	.280	.106	.123
Experience (total)	-.078	-.197	-.304	-.180	-.095	-.094
Experience (current dept.)	-.182	-.133	-.141	-.144	-.081	-.069
Experience (current job)	-.005	-.250	-.291	-.170	-.074	-.105
No.of courses	.308	-.028	-.118	-.026	.048	-.013
Satisfaction score	.306	-.338	.000	.103	-.311*	.427**

(*) Statistically significant at $p < 0.05$

Table (4): points to no statistically significant correlation between head nurses' scores of knowledge and practice before the intervention; However, after implementation of the intervention, there was a statistically significant moderate positive correlation between them ($r=0.577$), and this became strong ($r=0.812$) in the combined pre and post-samples. As regards the correlations with head nurses' characteristics, the table shows that the post-intervention knowledge score had a statistically significant weak positive correlation with their age ($r=0.381$). Meanwhile, the total knowledge and practice scores correlated negatively with head nurses scores of satisfaction with patient safety.

Table (5): Socio-demographic characteristics of staff nurses in the study sample (n=50)

	Frequency	Percent
Age:		
<30	20	40.0
30+	30	60.0
Range	19.0-55.0	
Median	32.0	
Gender:		
Male	3	6.0
Female	47	94.0
Marital status:		
Unmarried	16	32.0
Married	34	68.0
Nursing qualification:		
Diploma	49	98.0
Bachelor	1	2.0
Experience years (total):		
<20	35	70.0
20+	15	30.0
Range	1.0-28.0	
Median	10.5	
Experience years (current dept.):		
<5	17	34.0
5+	13	66.0
Range	1.0-20.0	
Median	7.0	
Experience years (current position):		
<10	23	46.0
10+	27	54.0
Range	1.0-28.0	
Median	10.0	
Attended training courses in:		
Infection control	32	64.0
Patient safety	14	28.0
Quality	2	4.0
Total courses attended:		
Range	0-1	
Median	0.0	

Table (5): The sample of staff nurses consisted mainly of females (94%) whose age ranged between 19 and 55 years, median 32.0. Almost all of them were diploma degree nurses (98%), and the majority was married (68%). Their medians years of total, current department, and current position experience were 10.5, 7.0 and 10.0 respectively. Slightly less than two-thirds of them had previously attended training in infection control (64.0%), while only two (4.0%) had training in quality.

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Table (6): Satisfaction with knowledge of patient safety goals as reported by staff nurses before and after the intervention

Patient safety areas:	Satisfaction with patient safety (max=2)				Mann Whiney Test	p-value
	Pre (n=50)		Post (n=50)			
	Mean±SD	Median	Mean±SD	Median		
Patient identification	1.7±0.5	2.00	1.1±0.5	1.00	27.75	<0.001*
Effective communication	1.6±0.5	2.00	1.1±0.4	1.00	25.48	<0.001*
Medication errors	1.5±0.6	2.00	1.1±0.3	1.00	20.96	<0.001*
Surgical errors	1.7±0.5	2.00	1.1±0.5	1.00	24.80	<0.001*
Nosocomial infections	1.6±0.5	2.00	1.1±0.5	1.00	24.16	<0.001*
Bed sores	1.6±0.5	2.00	0.8±0.5	1.00	41.08	<0.001*
Patient fall	1.6±0.5	2.00	0.8±0.5	1.00	37.40	<0.001*
Total satisfaction (max=100))	80.9±23.3	100.00	50.4±17.0	50.00	33.70	<0.001*

(*) Statistically significant at $p < 0.05$

Table (6): As displayed in, the scores of staff nurses' satisfaction with patient safety tended to be high before the intervention, and decreased after the intervention. The decreases were statistically significant in all areas of patient safety ($p < 0.001$). The total score of satisfaction decreased from 80.9 before the intervention to 50.4 after the intervention from a maximum of 100 ($p < 0.001$).

Table (7): Practice of PDCA in patient safety goals among staff nurses before and after the intervention

Adequate (60%+) practice in:	Time				X ² test	p-value
	Pre (n=50)		Post (n=50)			
	No.	%	No.	%		
General patient safety solutions:						
Two-way identification	0	0.0	40	83.3	70.40	<0.001*
Hand hygiene	0	0.0	25	52.1	34.38	<0.001*
Single injection devices use	0	0.0	49	98.0	96.08	<0.001*
Critical value tests list	5	10.4	50	100.0	79.81	<0.001*
Verbal/telephone orders	0	0.0	19	67.9	26.44	<0.001*
Catheter/tubing misconnection	0	0.0	35	79.5	54.55	<0.001*
Fall risk reduction	0	0.0	26	74.3	39.69	<0.001*
Reduce pressure ulcers	0	0.0	21	80.8	28.77	<0.001*
Handover communication	0	0.0	42	84.0	72.41	<0.001*
Medication management:						
Look-like sound-like medications	1	2.1	30	62.5	40.07	<0.001*
Concentrated electrolytes	1	2.0	48	96.0	88.40	<0.001*
Concentrated medications	1	2.0	50	100.0	96.08	<0.001*
All medications labelled	0	0.0	33	66.0	47.76	<0.001*
Operative/invasive procedures: Correct patient	0	0.0	40	97.6	71.08	<0.001*

(*) Statistically significant at $p < 0.05$

Concerning staff nurses' practice of PDCA in patient safety, Table 16 indicates that none or almost none of them had adequate practice in any of the areas before the intervention. At the post-intervention phase, there were statistically significant improvements in all areas. This reached 100% adequate regarding critical value test list, and concentrated medications

Table (8) Total practice of PDCA in patient safety goals among staff nurses before and after the intervention

Adequate (60%+) practice in:	Time				X ² test	p-value
	Pre (n=50)		Post (n=50)			
	No.	%	No.	%		
General	0	0.0	45	90.0	81.82	<0.001*
Medications	0	0.0	46	92.0	85.19	<0.001*
Operative/invasive	0	0.0	40	97.6	71.08	<0.001*

(*) Statistically significant at p<0.05

Table (8): indicates statistically significant improvements in all areas of practice of PDCA among staff nurses' after implementation of the intervention (p<0.001). The percentages of staff, nurses with adequate practice ranged between 90.0. %. For general patient safety to 97.6% for operative/invasive procedures.

Table (9): Correlation between staff nurses' knowledge and practice scores and their characteristics

	Spearman's rank correlation coefficient					
	Pre (n=30)		Post (n=30)		Total (n=60)	
	Knowledge	Practice	Knowledge	Practice	Knowledge	Practice
Practice	.456**		.186		.830**	
Age	-.204	-.074	.036	.029	-.042	-.011
Qualification	.211	.139	-.097	.094	.028	.058
Experience (total)	-.222	-.105	.027	-.010	-.058	-.038
Experience (current dept.)	-.124	-.054	.036	-.058	.020	.002
Experience (current job)	-.221	-.153	-.039	-.038	-.074	.077
No. of courses	.241	.028	.244	.007	.121	.009
Satisfaction score	-.127	.192	.102	-.153	.518**	.494**

(*) Statistically significant at p<0. 05 (***)Statistically significant al p<0.01

Table (9):demonstrates a statistically significant moderate positive correlation (r=0.456) between staff nurses' scores of knowledge and practice before the intervention. The correlation became strong (r=0.830) in the combined pre and post-samples. Meanwhile, no correlations were revealed with any of the staff nurses characteristics.

Discussion

Patient safety is the cornerstone of high-quality health care. Much of the work defining patient safety and practices that prevent harm have focused on negative outcomes of care, such as mortality and morbidity (*Carlesiet al., 2017*).

Nurses' role is critical in reducing such adverse outcomes of patient care to improve mortality and morbidity. one of the main head nurse's role in nursing administration is to achieve quality , particularly regarding patient safety (*Severinsson,2013*)the plan –Do-Check-Act (PDCA)model has been shown to be an effective quality management tool in improving patients'' outcomes(*Garrett et al.,2017* and augmenting the efficiency of organization to the maximum (*Johnson et al.,2016*).

The study was to investigate the effect of head nurses' and staff nurses' use of PDCA on their patient safety goals practices.

The present study hypothesized that the implementation of training program would lead to improvements in the knowledge of the head and staff nurses' of PDCA and application in patient safety goals.

The findings of the present study revealed that related to incident report statistically slightly significant improvement between pre and posttest in the participants 'knowledge regarding the patient identification, documentation of medications administration ,infections and falling. This result is consistent with *Chin Chen et al. (2017)* who found that most participants in the study(80%) had limited experience of medical incident

reporting; however, those who held managerial positions or had completed master's degree (72.73% of participants who completed master's degree were also in managerial work) reported a higher intention to report than those not in management roles or with a bachelor's degree as their highest qualification.

In satisfaction finding regarding to patient safety goals by head nurses the study found low satisfaction with patient safety goals before intervention and even decrease after intervention This result is consistent with *Hamid (2015)* who found that resident is not fully educated about patient safety standards and their role in patient safety. In this respect, *Sammer andJames (2011)* emphasized the role of nurse managers in increasing nurses' knowledge regarding quality and safety standards as well as in establishing a culture that offers the patient quality care in a safe environment.

In multivariate analysis, the implementation of the study intervention was identified as the only statistically significant inadequate positive predictor of head nurses knowledge score. In the same line *International Council of Nurses (2012)* nurse no matter how old she/he is, every head nurse carries personal responsibility and accountability for nursing practice, and for maintaining competency. Nurses maintained a standard of professional health.

In addition to the positive impact of the present study intervention on staff nurses' practice scores of PDCA in patient safety, their knowledge score was also identified as an additional significant positive predictor of this score. Moreover, their knowledge and practice scores were positively correlated. This indicates that the staff nurses' inadequate practice before the implementation of the

intervention was due to their deficient knowledge about PDCA. Thus, when their knowledge was improved after the intervention, this was positively reflected on their practice scores. Similar findings were reported by *Bauer et al. (2015)* in a study on operating room nurses in Germany.

Concerning head nurses' personal characteristics having significant effects on their knowledge and practice, the present study results revealed a negative correlation between their age and the knowledge scores. Moreover, the multivariate analysis demonstrated that head nurses' age and experience in current department were negative predictors of their practice scores. This might be explained by that the younger age head nurses who have been relatively more recently appointed to managerial positions might be more aware of innovative approaches and techniques to better patient safety management due to more freshness of their knowledge and also due to more innovative graduate and postgraduate nursing recent curricula. In line with this, a study in the United States demonstrated the success of training nursing students in PDCA as a quality improvement tool in enhancing their related competencies (*Flores et al., 2013*).

According to the current study results, almost none of the head nurses as well as the staff nurses had adequate practice of PDCA as applied to patient safety. While the finding could be expected among staff nurses, it was not expected that almost all head nurses had no awareness of this important approach to quality care in patient safety. This could be again due to lack of staff development activities to improve their knowledge and skills in quality as shown by the scarcity of attendance of such training among them. In congruence with

this, a study in Brazil highlighted the importance of staff development activities in enhancing nurses' performance related to patient safety (*Paranaguá et al., 2016*).

Conclusion

The study results lead to the conclusion that the implementation of a training program is successful in improving head and staff nurses' related knowledge and practice. Moreover, the program is effective in increasing the reporting of incidents related to patient safety. The score of head and staff nurses' knowledge and practice are positively correlated.

Recommendations

- The PDCA quality improvement cycle should be implemented in patient safety nursing as well as in various areas of patient care.
- The training program should be applied to all head and staff nurses in the study setting, and should be extended to other similar setting.
- Conduct a hospital wide awareness campaign to increase healthcare providers as (head nurses, staff nurse) with importance of patient safety goals and PDCA posters, videos and meetings.
- Periodical meeting must be conducted to discuss barriers that inhibit implementation of patient safety goals, and solve any incident report related medical errors and set action plan to help the organization to improve patient safety practice.
- Periodical assess level of knowledge related to patient safety ,quality and PDCA

Implementation of (Plan-Do-Check-Act) Process of Quality and Measuring its Effect on Nurses' Practice of Patient Safety Goals

- Further research is proposed to examine the effect of repeated PDCA cycle in the patient safety on patient and nurses 'outcomes.

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