PDCA Cycle: A mean for Improving Nurses' Performance regarding Medication Administration

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Abstract

Background: PDCA cycle provides effective approach for solving problems. It enables to improve nurses' medication administration knowledge and performance. **Aim of study:** Was to improve nurses' performance regarding medication administration by using PDCA Cycle. **Design:** A quasi experimental design one group pre, posttest was utilized in the study. **Setting:** This study was conducted at inpatient units in Alhelal Hospital. **Sample:** All nurses 60 nurses divided into 48 staff nurses and 12 head nurses, who were working in previous setting. **Tool:** Two tools to collect data, namely medication administration knowledge questionnaire and medication administration observational checklist. **Results:** Less than one fifth (18%) of nurses had satisfactory knowledge regarding medication administration before the implementation of PDCA cycle. While at post and follow up implementation PDCA cycle nurses' knowledge was highly improved related medication administration (98.2% & 97.3%) respectively. There was a highly statistically significant difference in nurses' medication administration knowledge among nurses throughout PDCA cycle. Slightly more than one fifth (21.7%) of nurses had satisfactory performance related medication administration before the implementation of PDCA cycle. While at post and follow up nurses' performance was highly improved related medication administration (96.7%). **Conclusion:** After the implementation of PDCA cycle nurses' knowledge and performance regarding medication administration were improved and medication errors were minimized. **Recommendations:** Implementation of PDCA cycle to improve different patient care procedures is highly needed and improve medical staff practice through complementing training program.

Keywords: Knowledge, Medication Administration, PDCA cycle, Performance.

Introduction

Medication administration is one in all the foremost frequently performed nursing tasks, accounting for about 40% of all nursing work, and may be a multidisciplinary, multistep process that requires several types of professional knowledge as the pharmacological characteristics of medications. Medication administration in clinical is a complex practice as a result of medication route and medical device diversification and increasing severity of patients' conditions. For this reason, most medical accidents are related to medication errors **(Kim and Lee, 2020).**

Medication administration is a core responsibility of nurses. Registered nurses across the globe are educationally prepared, morally responsible and professionally accountable to fulfill their roles safely. Nurses are in a position to commit, detect, and report medication errors. Nurses encounter the challenges of safe medication administration in the delivery of healthcare for patients **(Marten et al., 2019).**

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PDCA is an iterative four-step quality improvement and productivity improvement process typically used for the higher of the work strategy. PDCA is a successive and effective cycle start in small group to check potential effects on processes, and then ends up in larger and more targeted change (**Patel & Deshpande, 2017**).

The Plan-Do-Check-Act (PDCA) cycle is an integral a part of quality management as a tool of quality improvement. PDCA was designed to begin the process of planning to do improving, implement the process to do it, verifying whether the process is accomplishing requirements, and acting upon those requirements to maintain an acceptable performance level (**Demirel, 2019**).

P – Plan the change Define what expect to happen if make the change. After investigating the process and selecting an improvement opportunity should be able to identify what expect the results to be, and determine how large the pilot study of the improvement should be. It is best to work on a small group so improvements can be rapidly tested and analyzed (**Ho and Burger, 2020**).

D– Do the improvement. Implement the changes that you've decided upon. Document problems or unexpected observations during the implementation. discover what learning as you do the pilot (**Demirel, 2019**)

C–Check the results Compare the information to predictions. Compare the information to the measures that took before you made the change. Are the results were expected? How did they differ from were expected? Identify the teachings learned from the method of improvement. If the change wasn't successful, or didn't achieve the expected results, skip the Act stage and return to the Plan phase to change or create new ideas for solving the matter and bear the cycle

again. this is often a traditional a part of the development process! this can be also why it's best to pick out improvement opportunities which will rapidly proceed through the cycle. improvement process to find out that the change that was made isn't working and want to begin again within the Plan stage (**Patel & Deshpande, 2017**).

A – Act by implementing the change full scale (after successful completion of a pilot). Document the change that was made to the method and redefine the policies, procedures, guidelines, and/or protocols that the change affects. Communicate the change throughout the organization. Design measures and still assess the effectiveness of the change over time, in other words, hold the gain. Identify what has to be done to continuously improve the method (**Ho & Burger, 2020**).

Significance of the study

The main goal of hospital management is to provide and improve human health. Where PDCA cycle is a most common method applied in health care to manage quality and safety. Medication errors as are among the most common health threatening mistakes that affect patient care. Nurses are often the last responsible person in the administration process to prevent medication errors. So, it is important to take the time needed to ensure patient safety regarding medication errors, and to minimize distractions throughout the process. So, this study was conducted to improve nurses' performance regarding medication administration errors by using PDCA Cycle.

Aim of the Study

The present study aimed at improve nurses' performance regarding medication administration by using PDCA Cycle.

Research Hypothesis:

After the implementation of PDCA Cycle nurses' knowledge and performance regarding medication administration would be improved and medication administration errors will be minimized.

Subject and Methods

Research Design

Quasi-experimental design one group pre, posttest was utilized in conducting the study.

Setting

This study was conducted in the inpatient units at Alhelal Hospital, which affiliated to Special Medical Centers of the Ministry of Health. It is a general hospital which provides its services to the community through the Surgical, Medical, Neurological, Intensive Care Units besides the operating theaters and outpatient clinics. But it is more specialized in orthopedic surgeries.

Subjects

The subjects of the study included all nurses 60 nurses divided into 48 staff nurses and 12 head nurses, who were working in previous setting.

Tools of data collection:

Two tools were used to collect data:

I: Medication Administration Knowledge questionnaire: It was designed by the researcher based on literature review (**El Demerdash, Bahadori et al 2014; Yuswardi, 2013; Tabatabaee, Johromi and Asadi, 2013**). It aimed to assess nurses' knowledge regarding medication administration. It consisted of two parts:

Part 1: Personal and job characteristics data for nurses: it includes personal data of nurses including age, gender, marital status, educational qualification, years of experience, previous attendance of training program about medication administration, presence of procedure manual regarding medication administration and reading the medication administration procedure manual.

Part II: It consisted of 48 questions in the form of MCQ and True or False. to assess nurses' knowledge regarding medication administration distributed as the following: Basic pharmacology knowledge 5 items, medication order 5 items, pre medication administration 7 items, during medication administration 7 items, post medication administration 7 items, handling and storage of medication 5 items and high alert medication 9 items.

Scoring system:

Each question was scored, (one) for correct answer and (zero) for incorrect answer. The scores of items were summed-up. These scores were converted into percent scores. The total score was (48). Nurses considered had satisfactory knowledge when the total score was ≥60% (≥29). while the knowledge considered unsatisfactory if the score was <60% (<29) (**El Demerdash Mohamed, and Taha 2016).**

Second tool: Medication administration observation checklist:

It was designed by the researcher based on literature review (**Institute for safe medication practice 2019; El Demerdash, Feleke, Mulatu, and Yesmaw 2015; Potter and Perry 2013).** It aimed to assess nurses' performance regarding medication administration. It consisted of 86 items divided into six categories distributed as the following: Preparation 6 items, oral medication 13 items, Intravenous medication 17 items, Intravenous infusion 15 items, Intramuscular medication 19 items, Subcutaneous medication 16 items.

Scoring system

Each item was scored (1) for done and (zero) for not done. The total scores were 86,

the scores of the items were summed-up and the total divided by the number of the items, giving a mean score for the dimension. These scores were converted into percent score. The nurses' performance regarding medication administration was considered satisfactory if the percent score was ≤60%(≤52) while it considered unsatisfactory if < 60% (<52) **(Feleke, Mulatu, and Yesmaw, 2015).**

Tools Validity:

The tools of study were tested for face and content validity through distribution of the tool to a Panel of Experts. The validity of the tools was judged by nine experts specialized in Medical Surgical and Critical care Nursing. Four professors and one assistant professor in Critical Care Nursing, and two professors and two assistant professors in Medical Surgical Nursing from Ain Shams University. Based on jury recommendations and constructive remarks necessary modifications, corrections, addition and/or omission of some items were done.

Reliability of the tools: The reliability was measured by using Cronbach's Alpha coefficient. The test of reliability for the knowledge questionnaire was 0.89 and observational checklist was 0.86.

Ethical consideration:

At the interview with nurses to collect data, they were informed about the purpose and benefits of the study and the fact that their participation is voluntary and they have the right to refuse to participate in the study without giving any reason. Besides, confidentiality and anonymity of the subjects were assured through coding of all data.

Pilot study:

During the period from March to April 2020, a pilot study was conducted on 6 nurses representing 10% of the total study sample. The purpose was to examine the feasibility, and applicability of the tools, and clarity of the language. It also served in estimating the time needed to fill the tool 30-35 minutes for the medication administration knowledge questionnaires and an average of one hour for the medication administration observational checklist.

Field Work

Data collection of the study covering 7 months started at the beginning from May 2020 to the end of November 2020. Data was collected 2days per week over the three shifts (morning, afternoon, night) throughout the shift hours.

PDCA Cycle phases
I- Plan phase

Upon securing all permissions to conduct the study, the researcher met the nurses individually to explain the aim of the study and to get the approval to participate in the study. The medication administration knowledge questionnaire was distributed to nurses according to the predetermined unit schedule, the researcher was present all the time during filling for any clarification as needed and then, the researcher checked each one to ensure its completeness of questionnaire. The nurses' performance regarding medication administration was assessed by using the observational checklist. The observation was done during the time of medication administration were giving. The observation period was from 9 AM to 11.30 AM on the morning shift. and from 2 PM to 6 PM on the afternoon shift, while night shift starts observation period from 10 PM to 12 AM.

A participant observation approach was used to avoid any bias due to the process of observation. The data collected during this

phase constituted the pretest or baseline for the study.

Then, the researcher analyzed the collected data for knowledge and performance of medication administration to identify knowledge and performance deficiency regarding medication administration, determine the current strength and weakness point, and gaps between the actual and ideal performance. That considered during the preparing and development of the next phase.

II - Do phase

The program consisted of 12 theoretical hours and 14 practical hours. The program components included fundamental pharmacology, rights of medication administration, safety measures regarding medication administration, high alert medication, medication errors, and incident reports**.**

In this phase, the improvement opportunities detected in planning phase were implemented. Based on consultation with the nursing director. the nurses divided into four small groups, each group consists of 15 nurses according to availability and workload for conducting the training.

The program was implemented for two months, from the beginning of July 2020 to the end of August 2020. The program sessions were from 9:00 am to 11:00 am and from 11:30 am to 1:30 pm for the same group. The program sessions conduct 3 days per week (Saturday- Monday- Wednesday).

At the beginning of each session provide an orientation to the educational program to the nurses. Feedback was given at the end of each session about the current session and beginning of each session about the previous session and program situations given to participants to write their suggestions for alternative solutions.

Different methods of teaching were used such as lecture, group discussion, role play and brainstorming. Instructional media included video, demonstration, data show, job training and handout prepared by the researcher and distributed to participants on the first day of the educational program.

III- Check phase:

After completion of the training program, the knowledge and performance regarding the medication administration were assessed by using the same tools of data collection of the program and were assessed through posttests for the knowledge and performance of nurses. According to the result of post-program, the researcher determined deficiency or weak point in nurses' knowledge and performance regarding medication administration, then, the researcher takes corrective action by re-explain any point about medication administration or demonstrate any procedure of medication administration needed for improved deficiency.

IV- Act phase:

In this phase, the researcher started to follow up the proposed progress after implementing the training program and corrective actions were taken. using the same tools of data collection, and evaluate level of nurses' knowledge and performance improvement.

Statistical analysis:

Data entry and statistical analysis were done using statistical package for social sciences (SPSS) version 21. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative variables were analyzed using paired t-test when there were two independent categories, while repeated measurement. Cochran's Q test was used when there were

differences between three or more matched sets of frequencies. Chi square test was used to examine the relationship between two qualitative variables but when the expected count is less than 5 in more than 20% of the cells; Fisher's Exact Test was used. Statistical significance was set at p-value <0.01.

Results

Table (1): Shows that more than two thirds (68.3%) of nurses had age ranged from 30-40 years, more than four fifths of them (83.3%) were female. Regarding nursing qualifications, more than three fifths of them (63.3%) had nursing school diploma. also more than three quarters of them (76.7%) had years of experience ranged from 10-20 years.

Table (2): Shows that, total mean score of nurses' knowledge regarding medication administration at pre implementation PDCA cycle was18.98±3.582, and improved at post and follow up implementation PDCA cycle 46.76±2.219 and 45.38±4.009 respectively. Also there were highly statistical difference in nurses' medication administration knowledge among pre & post implementation PDCA cycle and post &follow up implementation PDCA cycle.

Figure (1): Shows the less than one fifth (18%) of nurses had satisfactory knowledge regarding medication administration at pre implementation PDCA cycle. While at post and follow up implementation PDCA cycle the total satisfactory knowledge were highly improved (98.2% & 97.3%) respectively.

Table (3): Clarifies the mean score of total nurses' performance regarding medication administration at pre implementation PDCA cycle was

41.53±11.23, and improved at post and follow up implementation PDCA cycle 80.55±10.335 and 80.75±8.043 respectively. Also, there was highly statistical significant difference in nurses' medication administration performance.

Figure (2): Shows that slightly more than one fifth (21.7%) of nurses had satisfactory performance related medication administration at pre implementation PDCA cycle. While at post and follow up implementation PDCA cycle were highly improved of nurses' performance related medication administration (96.7%).

Table (4): Reveals that there was a highly positive statistically significant correlation between nurses' knowledge and their performance regarding medication administration at the post and follow up implementation PDCA Cycle.

Table (1): Personal characteristics of nurses (n= 60)

Personal characteristics	No.	%
Age		
< 30 years	19	16.7
30-39 years	41	68.3
> 40 years	9	15
Gender		
Male	10	16.7
Female	50	83.3
Educational qualification		
nursing school diploma	38	63.3
High diploma	12	20
Bachelor degree in nursing	10	16.7
Years of Experience		
< 10 years	7	11.7
10- 20 years	46	76.7
> 20 years	7	11.7
Presence of procedure manual regarding medication administration		
Yes	60	100
Reading the procedure manual medication administration		
Yes	20	33.3
No	40	66.7

Table (2): Mean scores of nurses' knowledge regarding medication administration pre, post and follow up the implementation of PDCA cycle

Nurses' knowledge	Maximum score	Pre PDCA Mean± SD	Post PDCA Mean ±SD	Follow up PDCA Mean ±SD	T_1	P_1	t_2	P_2
Basic pharmacology knowledge	5	2.300±1.381	4.983±.129	4.750±.773	15.155	.000**	12.647	.000**
Medication order	5	1.867±1.096	5.00±.000	4.567±1.095	22.135	.000**	14.166	.000**
Pre medication administration	10	4.600±1.463	9.850±.445	9.367±1.207	29.096	.000**	22.510	.000**
During medication administration	7	2.300±1.046	6.816±.504	6.350±.819	30.628	.000**	24.236	.000**
Post medication administration	7	2.600±1.291	6.900±.354	6.633±.758	25.258	.000**	20.433	.000**
Receiving and storing medication	5	2.167±.847	4.967±1.284	4.816±.390	24.670	.000**	20.766	.000**
High alert medicines	9	3.150±1.039	8.250±1.284	8.900±1.206	21.597	.000**	41.111	.000**
Total nurses' knowledge	48	18.983±3.582	46.767±2.219	45.383±4.009	53.40	.000**	40.36	.000**

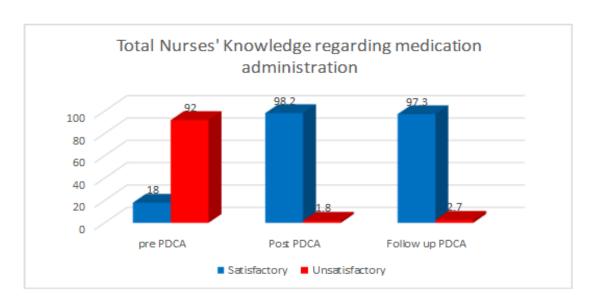**PDCA Cycle: A mean for Improving Nurses' Performance regarding Medication Administration**

Figure (1): Total Nurses' Knowledge regarding medication administration throughout the implementation of PDCA cycle

Table (3): Mean scores of nurses' performance regarding medication administration between pre, post and follow up the implementation of PDCA cycle (n=60)

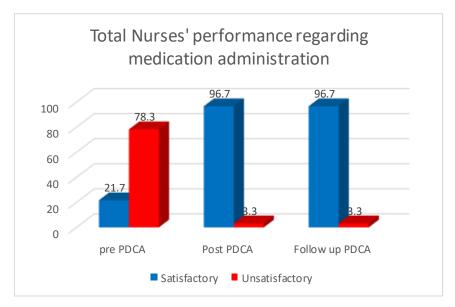| Performance dimensions	Max score	Pre PDCA	Post PDCA	Follow up PDCA	t_1	p	t_2	p
		Mean +SD	Mean +SD	Mean +SD				
Medication Preparation	6	2.433±1.332	5.416± 1.680	5.330± 1.816	17.664	.000**	16.664	.000**
Oral Medication Administration	13	6.050±1.094	12.383±1.766	12.433±1.293	20.639	.000**	22.373	.000**
Intravenous medication	17	6.966±2.962	15.766±2.60	15.916±2.01	21.711	.000**	22.771	.000**
Intravenous infusion	15	8.516±1.361	14.183±1.808	14.133±1.661	19.423	.000**	16.832	.000**
Intramuscular injection	19	8.966±1.167	17.683±2.632	17.850±1.998	23.717	.000**	21.830	.000**
Subcutaneous injection	16	8.600±2.811	15.116±1.616	15.116±1.316	19.761	.000**	18.177	.000**
Total nurses' performance	86	41.533±11.23	80.550±10.335	80.750±8.043	30.199	.000**	27.872	.000**

Figure (2): Total Nurses' performance regarding medication administration throughout the implementation of PDCA cycle

Table (4): Correlation between nurses' knowledge and performance regarding medication administration at pre, post and follow up implementation PDCA cycle.

Performance Knowledge	Pearson Correlation	Total nurses' performance pre PDCA	Total nurses' performance post PDCA	Total nurses' performance follow up PDCA
Total nurses' knowledge pre PDCA	r	.222		
	p- value	.88		
Total nurses' knowledge post PDCA	r		.877	.630
	p-value		.000**	.000**
Total nurses' knowledge follow up PDCA	r			.636
	p- value			.000**

Discussion

Results of this study revealed that total nurses' knowledge regarding medication administration less than one fifth of nurses had satisfactory knowledge regarding medication administration at pre implementation PDCA cycle. While at post and follow up implementation PDCA cycle were highly improved of nurses' knowledge related medication administration. also there was a highly statistically difference in nurses' medication administration knowledge among pre &post implementation PDCA cycle and post &follow up implementation PDCA cycle.

On the same line **Abukhader & Abukhader (2020)** who indicated that only minority of the nurses had satisfactory knowledge at pre-test about the safety medication administration where this percentage was improved to have an increased satisfactory level after the educational program and related sessions as majority of nurses had satisfactory knowledge about the safety medication administration.

Regarding total nurses' performance, the forgoing study reveals that slightly more than one fifth of nurses had satisfactory performance related medication administration at pre implementation PDCA cycle. While at post and follow up implementation PDCA cycle were

highly improved of nurses' performance related medication administration. also there was a highly statistically difference in nurses' medication administration performance among pre &post implementation PDCA cycle and post &follow up implementation PDCA cycle.

Supported finding with **Ho & Burger (2020)** who mentioned that following a series of PDCA cycle implementations, medication administration improved from through implementation of PDCA cycle for improving medication safety practice.

Similar finding **Seliem (2018)** who reported that after implementation of PDCA process studied nurses had adequate improvement practice regarding patient safety goals. Although **Wang et al. (2015)** who mentioned that after implement PDCA cycle related quality improvement program the medication administration errors were reducing and promoting the awareness of medical staff.

Results of this study revealed that there was a positive statistically significant correlation between nurses' knowledge and their performance regarding medication administration at the post and follow up implementation PDCA Cycle.

This result may be attributed to studied nurses had insufficient knowledge regarding medication administration, shortage of nurses especially during COVID 19 pandemic and increase workload that reflect in their performance regarding medication administration, while after implementation PDCA cycle nurses' knowledge and performance were improved.

This finding agreed with **Chen et al. (2020)** who reported that The PDCA cycle helps to standardize nursing management in COVID-19 by developing and applying effective nursing management approaches through staff training related safety medication administration.

Saaid et al., (2020) who evident that there was a statistically significant difference correlation between head nurses' management regarding applying international patient safety goals using the PDCA model and patient's safety culture.

Conclusion

There was a highly statistically difference in nurses' medication administration knowledge among pre & post implementation PDCA cycle and post & follow up implementation PDCA cycle.

Slightly more than one fifth of nurses had satisfactory performance related medication administration before the implementation of PDCA cycle. While at post and follow up the implementation of PDCA cycle highly improvement of nurses' performance related medication administration was observed.

The study finding evident that there was high statistical positive correlation between nurses' knowledge regarding medication administration and their performance. The present study finding supported the research hypothesis which was "after the implementation of PDCA cycle nurses' knowledge and performance regarding medication administration will be improved and medication administration errors will be minimized".

Recommendations

- Hospital have to establish policies for implementing PDCA cycle.
- Enhance zero blame culture to encourage nurses for applying incident report for medication administration errors.
- Conduct periodic meeting for discussion and solving obstacles facing nurses to achieve medication administration process

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تحسين أداء التمريض تجـــاه إعطــاء العــلاج باستخدام دورة بيدكــا

يمني المتولي بدر- رباب محمود حسن- فوزية فاروق كامل

تعد سلامة المرضي تحديًا عالميًا بشأن الرعاية الصحية ومن أكثر المخاطر التي تهدد سلامة المرضى أخطاء إعطاء الدواء لأنها قد تؤدي إلى اعتلال ووفاة المريض. يعتبر التمريض هو خط الدفاع الأول للمريض، لذلك يجب أن يكون لديهم المعلومات الحديثة التي تتعلق بسلامة إعطاء الدواء . لذلك هدفت هذه الدراسة الي تحسين أداء التمريض تجـــاه إعطــاء العــلاج باستخدام دورة بيدكــا. وقد أجريت الدراسة في الأقسام الداخلية للمرضي بمستشفي الهلال التابعة لأمانة المراكز الطبية المتخصصة وكانت العينة البحثية جميع الممرضين الذين يعملون بالأقسام الداخلية للمرضي وعددهم ٦٠ ممرض وممرضة.١٢ مشرفة وحدة و٤٨ ممرض. حيث كشفت النتائج بوجود علاقة ارتباط ذات دلالة إحصائية بين مستوى الممرضين الخاضعين للدراسة وأدائهم فيما يتعلق بإعطاء الدواء في المراحل المختلفة لتنفيذ دورة بيديكا. وقد اوصت الدراسة بأنه من المهم تقديم الدورات التدريبية بيديكا للممرضين لتحسين اداءهم.