

## Effect of Chemotherapy Nursing Protocol Application on Patients' Care Competency, Safety and Satisfaction

**Badria Mahrous Abdelhameed Mohammed<sup>1,2</sup>, Sohier M. Weheida<sup>3</sup>, Rehab Abd Allah Nassar<sup>4</sup>, Wael Alghamdi<sup>5</sup>, Rabab Morsy Ahmed<sup>6</sup>, Asmaa Hamed Abd Elhy<sup>1</sup> & Hassnaa Eid Shaban Mosa<sup>1,7</sup>**

<sup>1</sup>Assistant prof. of Medical Surgical Nursing, Faculty of Nursing, Menoufia University, Egypt.

<sup>2</sup>Assistant prof. Nursing, Faculty of Applied Medical Science, Albaha University KSA

<sup>3</sup>Prof.of Medical Surgical Nursing, Faculty of Nursing, Alexandria University, Egypt.

<sup>4</sup> Assistant prof. of Nursing administration, Faculty of Nursing, Menoufia University, Egypt.

<sup>5</sup> Assistant prof. of Rehabilitation, Faculty of Applied Medical Sciences, Albaha University, KSA.

<sup>6</sup> Lecturer of Community Health Nursing, Faculty of Applied Medical Science, Albaha University KSA

<sup>7</sup>Assistant prof. Medical Surgical Nursing, Nursing Faculty, Jouf University. KSA.

### Abstract

High qualified specialized oncology nurses are considered the backbone in any chemotherapy administration agency. Using standardized protocol for administration of chemotherapy is a pressing demand for prevention of medication errors with promotion of patients' safety and satisfaction. **Aim:** Evaluate the effect of chemotherapy nursing protocol application on patients' care competency, safety, and satisfaction. **Design:** Quasi experimental design. **Setting:** Oncology institution of Menoufia University. **Subjects:** A convenience sample of 44 oncology nurses and 36 patients receiving chemotherapy. **Tools:** Socio-demographic questionnaire, Oncology Nurses' knowledge questionnaire, Self-assessment chemotherapy related clinical competency questionnaire, Patient safety culture questionnaire and patients' satisfaction questionnaire. **Results:** The number of reported errors decreased throughout study phases with high statistically significant difference. The total knowledge score of studied nurses was improved from 7.75 pre protocol application to 21.45 immediately post protocol application with high statistically significant difference. The total nurses' competency score was improved from 48.79 to 88.50 then 87.57 respectively with high statistically significant difference. The total patients' satisfaction score was improved from 10.61 to 25.29 then 25.09 respectively with high statistically significant difference. **Conclusion:** A considerable improvement was observed in oncology nurses' knowledge, clinical competency and patients' safety and satisfaction after chemotherapy nursing protocol application. In addition, there was positive correlation between nurses' knowledge and competency and both patients' safety and satisfaction. **Recommendation:** Application of chemotherapy nursing protocol is recommended routinely for managing all chemotherapy patients.

**Keywords:** Care competency, Chemotherapy Nursing Protocol, Patients' Safety & Satisfaction.

## Introduction

Cancer is a serious health problem disturbing cancer patients' outcome both directly and indirectly according to the disease itself and the utilized line of treatment. Health care professionals have lately started systematically evaluating patient safety, satisfaction and the quality of nursing care which provided for those patients throughout their disease process and consequent treatments line (1).

Several American safety institutions approved international safety rules and guidelines for managing chemotherapy. Egyptian oncology nurses subsequently modified these recommendations to develop their own chemotherapy administration's standards and a standardized nursing care routine (2). Oncology nurses must be talented in chemotherapy management as it affects how they handle these medicines in their regular work and increases the risk of error, which not solitary harms patients but similarly nurses. Care quality indicating to possess the necessary related information as well as the practical competencies to deliver safe and effective management (3).

As a result, to ensure the patients' safety and satisfaction, nurses must possess certain knowledge and practice skills to achieve these goals (4). Since it is the nurses' responsibility, patient safety and satisfaction-related initiatives are now more limited than those connected to secondary care. Nursing's top priorities are patient satisfaction and safety, and this is how nursing quality of care will be improved (5).

The most important consideration in all nursing care is patient safety. In addition, what procedures and processes are awarded and penalized in terms of patient

safety to deliver contented, safe and competent interventions. The rate of medication errors decreased because of the hospital's enhanced awareness of patient safety. Consequently, it is urgent for healthcare providers to evaluate the existing level of their patients' safety and recognise areas of priority to target of perfection to improve patient safety (5).

The development and validation of nursing care standards for chemotherapy patients have been the subject of numerous studies, but none have examined the impact of using these standards to improve oncology nurses' knowledge, competency, and patients' safety and satisfaction. These may be pertained to some barriers such as the insufficient in-service training, incomplete facility, multitasking, work pressure, lack of awareness, improper beliefs, and deprived agreement of nurses with safety measures (6).

A definite safety standard for chemotherapy application have settled by the American Society of Clinical Oncology and the Oncology Nursing Society, rendering to these standards, each hospital develops a full educational program and measures nursing competency at definite intervals (7). However, almost of chemotherapy centres and hospitals provide initial education and training programs, which may increase the chance of medication errors, complications and violating patient safety which will negatively affect patient safety and satisfaction. On the other side a common method to assess nursing competency about safe-handling techniques haven't been developed. So, it is vital for oncology hospitals to run an educational program regarding safe chemotherapy handling strategies for their nursing staff (8).

A comprehensive training program for oncology nurses is needed for administer chemotherapy with greater proficiency. Additionally, the program will demonstrating essential and best competencies while administering chemotherapy to improve their patients' safety, minimize the number of reported events while administering chemotherapy, illustrate appropriate nursing interventions while providing a holistic nursing care for chemotherapy patients, and participate as a leader in their oncology institution with standardized nursing care protocol for chemotherapy administration, which is considered as a cornerstone to improving their patients' safety <sup>(9)</sup> .

#### **Study significance**

Egypt is the first three ranked countries in relation to cancer deaths as it was the cancer burden leading country with average incidence 134,632 new cases and 89,042 deaths in 2020 <sup>(10)</sup> . So, Egypt has focused in training all specialized medical and oncology staff with more innovative substructure for cancer diagnosis, surgical treatment, systemic therapy, and chemotherapy services. Oncology nurses have vital roles in care of cancer patients undergoing chemotherapy, safety of these patients accomplished with application of evidence-based protocols, continued nurses' education, energizing and updating through deliberating a standardized protocol of care which acts as a tool or strategy to prevent patients' harms. Hence the building blocks related to quality of patients' care are knowledge and practice competence to provide appropriate care to those patients and prevent complications <sup>(11)</sup> .

Enhancing nurses' clinical competency and their knowledge base can equip nurses

to develop well-planned care plans which will be free from errors or complications which is an essential for improving patients' conditions, maintaining patient safety, and satisfying them. Therefore, by implementing this standardized nursing care protocol for chemotherapy will assist in extending the oncology nurses' competency and knowledge base to enable them to administer safe patient protocol of care.

#### **Aim of the study:**

Evaluate the effect of chemotherapy nursing protocol application on patients' care competency, safety, and satisfaction.

#### **Research hypotheses:**

- 1- Oncology nurses who received chemotherapy nursing protocol exhibit improvement in their knowledge level.
- 2- Oncology nurses who received chemotherapy nursing protocol exhibit improvement in their clinical competency level.
- 3- Oncology patients' safety accompanied with chemotherapy administration will be improved with reduction of reported error events after chemotherapy nursing protocol application.
- 4- Oncology patients' satisfaction level will be improved after chemotherapy nursing protocol application.

#### **Methodology:**

**Design:** Quasi-experimental design was used.

**Setting:** The oncology institution of Menoufia University.

**Subjects:** A convenience sample of 44 oncology nurses working in chemotherapy unit as well as 36 patients receiving chemotherapy were included to collect data.

#### **Inclusion criteria:**

All Oncology nurses were recruited to the study without exclusion. Patients who were assigned to receiving the chemotherapy were recruited if (1) receiving only one session of chemotherapy (2) with no previous history of chemotherapy administrations nor complications.

**Tools:** Five tools were used:

**I- Socio-demographic questionnaire:**

Developed by researchers to gather the demographic data of both of:

- A- Oncology nurses as age, educational level and years of experience.
- B- Oncology patients as age, sex and tumor site.

**II-Oncology Nurses' Knowledge**

**Questionnaire:** developed by researchers after extensive related literature review to collect nurses' basic and advanced care knowledge related to protocol for chemotherapy administration, patients' safety protocol, common complication and nursing actions. It was 24 a multiple-choice question with only one choice is correct.

**Scoring system:**

The score was divided to zero for wrong/missed answer, one for right answer; Answers were computed to obtain total mean scores to categorized as 0 to 8 indicates poor; 9 to 16 indicates average and 17 to 24 indicates high knowledge level.

**III: Self-assessment chemotherapy clinical competency questionnaire:**

Developed by **Diab et al., (2010)** <sup>(12)</sup> to assess a nurses' clinical competency during administering chemotherapy to patients. It includes 24 questions related to chemotherapy administration, side effect management and related patients' education as (competencies of double

gloving and gowning when initiating, terminating chemotherapy and proper chemotherapy waste disposal, disposing of gloves in a chemotherapy-approved container, safe discarding the chemotherapy bag and tubing after disconnecting chemotherapy infusions and meticulous hand washing after chemotherapy administration as well as protecting work surfaces during administration).

**Scoring system:**

Total score of proficiency scale was 96 degrees; one degree for no experience / missing answer, two degrees for limited experience, three degrees for highly experienced; then coding system represented as scoring from 1 to 32 indicated poor practice, scoring from 33 to 64 indicated inefficient practice, and finally scoring from 65 to 96 indicated efficient practice.

**Hospital Survey on Patient Safety Culture (HSOPC) questionnaire:**

Used to appraise patient safety at several levels including individual, unit and hospital levels (table A) <sup>(13)</sup>. This 42 items questionnaire grouped in 12 dimensions <sup>(14)</sup>. Each dimension contains 3-5 items rating with a 5-point Likert scale. It assesses overall patients' safety and number of error events reported <sup>(15)</sup>. The execution and evaluation of organizational practices led to changes in respondents' safety <sup>(16)</sup>. Originally developed in USA and used for several research <sup>(17)</sup>. It translated into 30 different languages and validated for use in more than 60 countries <sup>(18)</sup>. In regard Arabic version of the tool, **Alahmadi (2010)** <sup>(19)</sup> mentioned that it was revised by expert panel of healthcare professionals and academic staff in Saudi Arabia, and they were

confirmed its suitability for assessment of hospital factors affecting patient safety in Saudi Arabia.

**Table (A): Component of hospital survey about patient's safety**

	Dimensions	No.
1	Patients' overall safety perception	Four
2	Events reported frequency	Three
3	Expectations of manager /supervisor and patient safety promoting actions	Four
4	Continuous improvement/ learning of organization	Three
5	Teamwork in units	Four
6	Teamwork across units	Four
7	Openness of communication	Three
9	Error related feedback and communication	Three
9	Error non-punitive response	Three
10	Staffing	Four
11	patient's safety hospital management support	Three
12	Handoffs and transitions of hospital	Four
patient's Safety Score		
Number of Error Events Reported		

**V-Questionnaire for Short Assessment of Patient Satisfaction (SAPS): Settled by Hawthorne et al., (2009) <sup>(20)</sup> to evaluate patient's satisfaction, it included seven items that test: treatment satisfaction, explanation of treatment outcomes, clinician care, involvement in medical decision-making, respect for the clinician, time spent with the clinician, and satisfaction with unit care. The Cronbach's alpha  $\alpha$  was 0.85 where it was validated in clinical settings by Hawthorne et al., (2009) <sup>(20)</sup>. The researchers collected three evaluation points from chemotherapy patients: after first, fourth and eighth sessions.**

**Scoring system:**

Using 5-points Likert scale (0–4), responses related scores were ranged from 0 (extremely dissatisfied) to 28 (extremely satisfied). then total score was computed and categorize as: 0 - 5 extremely dissatisfied, 6 - 10 dissatisfied, 11- 15 satisfied to some extent 16 - 20 satisfied and > 20 extremely satisfied.

**Validity:**

All study's variables were put to the test with the forementioned tools. Five specialists in the fields of medical-surgical nursing and oncology nursing assessed each questionnaire to ensure its relevance, clarity, and thoroughness.

**Reliability:**

The test-retest method, which uses the same instrument on the same sample at two separate evaluation times, was used to assure reliability and these patients were excluded from the sample. The reliability of tool I was 0.89, tool II was 0.92, tool III was 0.89, tool IV was 0.88 and tool V was 0.85.

**Pilot study:**

Five nurses and four chemotherapy patients participated in a pilot study to assess the tools' clarity, viability, application, and the time required to complete each tool. Once the necessary refinement had been made, the results were stabilized by excluding the pilot sample from the whole sample.

**Ethical considerations**

Formal approval was taken from the Research Ethics Committee of the Faculty of Nursing at Menoufia University (Ethics code, 914).

The medical and nursing directors of the Menoufia University Hospitals oncology institute gave their written consent for the study to be carried out in the study setting. The department head also received official approval from the hospital director encouraging the oncology nurse to take part in the study.

The study's objectives and results were explained to oncology nurses and patients who chose to participate, assuring them that their participation was voluntary and that they had the opportunity to decline without repercussions. The confidentiality of the information was protected for both the nurses and the patients, with the researcher only having the right to review.

**Administrative considerations:**

-In order to enable the researcher to collect data, the goals and contents of the instruments were communicated to both nursing staff and patients. Research ethics were carefully observed during the study's execution.

-Oncology nurses answered to the surveys on socio-demographics, oncology nurses' knowledge, self-assessment clinical competency related to chemotherapy, and

hospital survey on patient safety using Google Forms.

-To enable the researcher to assess the impact of the protocol's implementation on the study's outcome variables, three data collection points were used: before, immediately after, and one month after implementation.

-Pre-protocol application test was finished on one day, when the initial assessment was done to gather baseline data, and then the patient received standardized chemotherapy administration nursing care protocol. Next, the pre-protocol application test was completed, followed by the immediate post-protocol implementation test, and finally the one-month post-protocol implementation test.

-Data were gathered during a three-month period, from June to August 2022. First, five nurses from each shift were divided into small groups to introduce them to the goals of the standardized nursing care protocol for administering chemotherapy. Brief interactive lectures and group discussions were held for each group during the teaching sessions. Each session lasted thirty minutes, and the first week's schedule included five sessions. The following week, the same sessions were held.

- Ongoing feedback was promised to dispel any misunderstandings and advance nurses' learning. To accomplish the goals of the study, audio-visual tools like computer-based learning, illustrated images, and films were used.

**The designed nursing chemotherapy protocol:**

The standardized chemotherapy administration nursing care protocol is a holistic nursing care plan for safe chemotherapy administration. **Puzanov et**

al., (2017) <sup>(21)</sup> designing it as a cornerstone for oncology nurses was altered after considering an updated literature review to create this training plan for oncology nurses. This training package was tailored in accordance with the availability of nurses.

**General objectives:**

Upon completion of chemotherapy nursing care protocol, oncology nurses will gain more knowledge and clinical competencies related to chemotherapy administration which will be reflected on patients' safety and satisfaction.

**Specific objectives:** Upon completion of protocol application, the oncology nurses will be able to:

1. Apply appropriate nursing interventions while providing holistic nursing care for Oncology patients.
2. Educate Oncology patients based on their special needs.
3. Eliminating reported error events while administering chemotherapy.
4. Demonstrate necessary competencies while administering chemotherapy to improve patients' safety.
5. Be a leader while applying the chemotherapy protocol which is considered as a cornerstone in patients' satisfaction.
6. Be well-equipped with competencies and knowledge to eliminate error/ reported event while administering chemotherapy.

**Evaluation and follow up:**

After the first assessment, reassessment was done twice, immediately and one-month post-application using all tools except Tool I. Comparison between the two post times evaluations was done to evaluate the effect of chemotherapy nursing protocol application on patients' care competency, safety and satisfaction.

**Data management:**

To verify for any incorrect or missing data, the study data underwent manual coding. To avoid any data entering errors, researchers double-checked their data entry. To ensure correctness and dependability, the data were reviewed and cleaned up using a preliminary frequency distribution.

**Statistical analysis:**

The one-way ANOVA test, T-test, Pearson correlation analysis, and mean and standard deviation (SD) were used to evaluate the associations among the quantitative variables. Data were presented using the SPSS program (version 22) in numbers and percentages. The P value of <0.05 was chosen as the significant level.

**Results**

**Table (1-A): Socio-demographic data of studied oncology nurses,** shows that the mean age of studied nurses was 30.13 years, while the mean years of their experience was 11.6 years. With respect to professional educational qualification, it was observed that (43.2%) of them had bachelor degree in nursing and (56.8%) had nursing diploma.

**Table (1-B): Socio-demographic data of studied oncology patients,** indicates that, more than three quarters of studied patients (77.77%) were over 40 years and 72.3% of them were female. In relation to the tumor location the bladder cancer was affecting a third of studied patients (33.4%).

**Figure (1): Oncology nurses' mean knowledge score throughout the study phases,** presents that the mean knowledge score of studied nurses was 7.75 pre-protocol application then, increased immediately post protocol application to 21.45 with statistically significant difference ( $p < 0.001$ ).

**Table (2): Competency level among**

**studied Oncology Nurses throughout Study Phases**, clarifies that the total competency score of studied nurses was 48.79 pre-protocol application, then, increased immediately post- protocol application and one month post protocol application by 88.50 and 87.57 respectively with statistically significant difference ( $p < 0.001$ ).

**Table (3): Differences among oncology nurses regarding patient's safety throughout the study phases**, illustrates the statistically significant differences among oncology nurses regarding all patient safety subscales throughout study phases except for teamwork across units, staffing and patient's safety hospital management support with  $p < 0.001$ .

**Figure (2): Reported errors throughout the study phases among studied nurses**, displays that, the number of errors reported by studied nurses was decreased throughout study phases. Pre-protocol application, 47.7% of the studied nurses reported 3 to 5 events. However, no event reported immediately post protocol application and one month post protocol application (63.8%, and 65.9% respectively) with high statistically significant difference ( $p < 0.001$ ).

**Table (4): Patients' satisfaction level throughout study phases**, describes that, the total patient satisfaction score was 10.61 pre- protocol application, then, increased immediately post protocol application and continued to be high at one month post protocol application by 25.09 and 25.29 respectively with statistically significant difference ( $p < 0.001$ ).

**Table (5): Correlation matrix among oncology nurses' age, experience,**

**knowledge, competencies and patients' safety and satisfaction**, draws a correlation matrix between age, experience, knowledge competency and patient satisfaction. There is a significant positive correlation between oncology nurses' knowledge, competency and patient's safety and patient satisfaction.

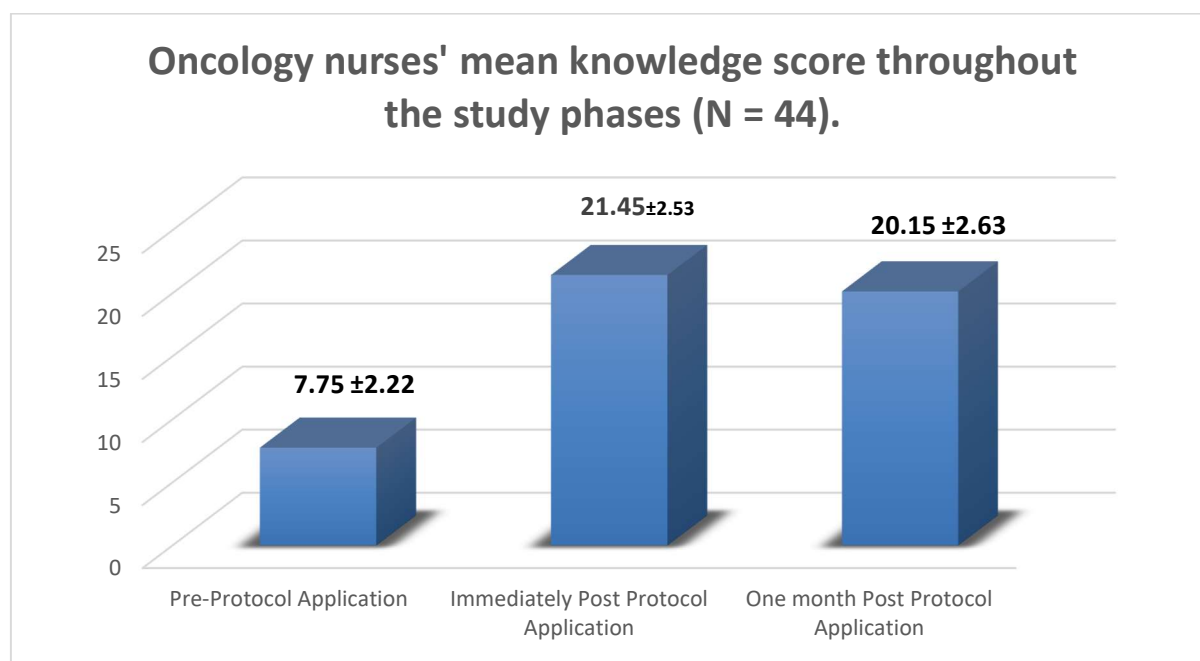


**Table (1-A) Socio-demographic data of studied oncology nurses (N=44)**

<b>Socio-demographic data</b>	<b>No.</b>	<b>%</b>
<b>Age (years)</b>		
23 < 29	11	25
29-34	26	59.09
> 34	7	15.90
X±SD	30.13 ± 5.7	
<b>Years of experience</b>		
1 < 6	11	25
6- 10	10	22.7
> 10	23	52.3
X±SD	11.66 ± 5.08	
<b>Educational level</b>		
Diploma	25	56.8
Bachelor	19	43.2

**Table 1: (B) Socio-demographic data of studied oncology patients (N=36)**

<b>Socio-demographic data</b>	<b>No.</b>	<b>%</b>
<b>Age</b>		
20-29	3	8.34 %
>29≤ 40	5	13.8 %
> 40	28	77.77 %
<b>Gender</b>		
Male	10	27.77 %
Female	26	72.33 %
<b>Tumor site</b>		
Breast	10	27.77 %
Prostate	6	16.6 %
Colon	8	22.33 %
Bladder	12	33.4 %



**Figure 1: Oncology nurses' mean knowledge score throughout the study phases (N = 44).**

**Table 2: Competency level among studied Oncology Nurses throughout Study Phases (N = 44).**

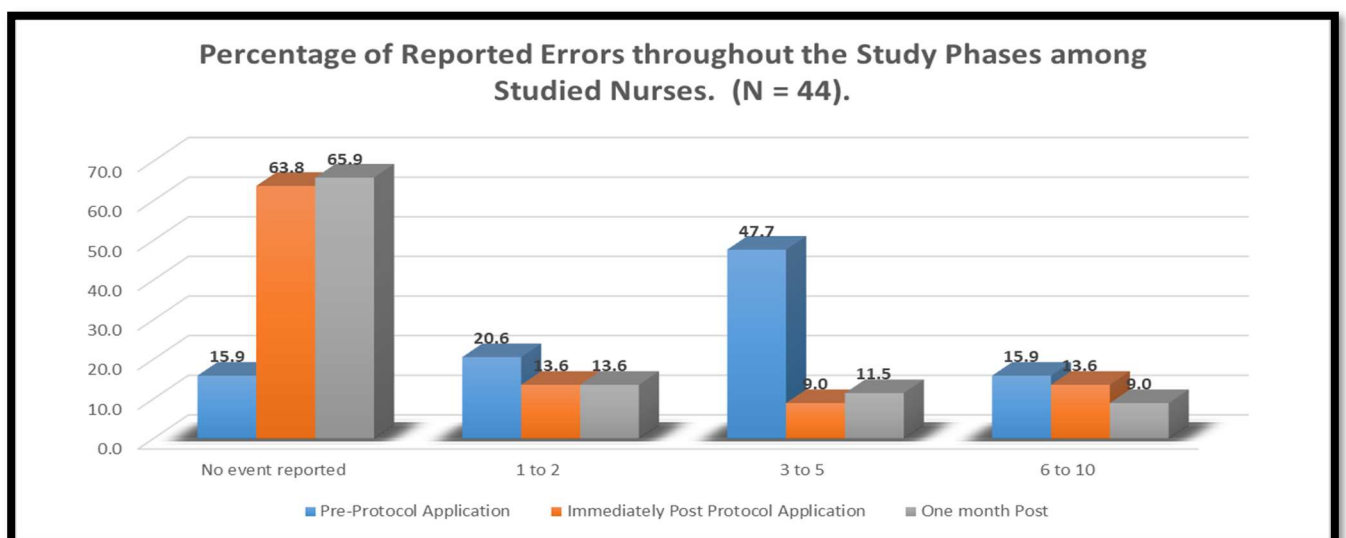
Items	Study phases						F- P value
	Pre-Protocol Application		Immediately Post Protocol Application		One month Post Protocol Application		
	No.	%	No.	%	No.	%	
Poor practice	26	59%	2	5%	2	5%	F = 168.59 P value <0.001**
Inefficient practice	13	30%	9	20%	11	25%	
Efficient practice	5	11%	33	75%	31	70%	
<b>Total</b>	44	100%	44	100%	44	100%	
$\bar{x} \pm SD$	48.79± 24.01		88.5± 31.36		87.57± 33.02		

(\*\*) Significant result.

**Table 3: Differences among oncology nurses regarding patient's safety throughout the study phases (N = 44).**

Items	Study phases						F- P value
	Pre-Protocol Application		Immediately Post Application		One month Post Application		
	Mean	± SD	Mean	± SD	Mean	± SD	
1-Patients' overall safety perception	9.77	1.91	12.90	0.811	12.97	0.820	22.69**
2-Expectations of manager /supervisor and patient safety promoting actions	6.00	1.72	13.45	1.21	13.00	1.24	26.34**
3-Continuous improvement/ learning of organization	5.50	2.07	11.82	2.60	10.72	2.68	10.42**
4-Teamwork in units	6.86	2.29	14.79	1.70	14.54	1.74	18.38**
5-Teamwork across units	8.95	2.57	8.98	2.56	8.90	2.08	0.590(NS)
6-Openness of communication	7.56	2.29	10.10	2.40	9.93	2.43	5.07**
7-Error related feedback and communication	7.06	1.35	12.77	1.97	11.72	1.99	10.26**
8-Error non-punitive response	9.92	2.08	6.15	1.96	5.95	1.62	5.64**
9-Staffing	8.84	3.22	8.88	3.28	7.44	3.42	9(NS)
10-Patient's safety hospital management support	5.75	1.90	5.71	1.91	5.15	1.92	9(NS)
11-Handoffs and transitions of hospital	5.63	1.54	8.83	1.58	8.68	1.58	11.96**
<b>Total</b>	<b>76.79</b>	<b>12.59</b>	<b>153.02</b>	<b>7.53</b>	<b>152.12</b>	<b>7.58</b>	<b>34.45**</b>

(\*\*) Significant result

**Figure 2: Reported errors throughout the study phases among studied nurses. (N = 44).**

**Table 4: Patients' satisfaction level throughout study phases (N = 36)**

Items	Study phases						F- P value
	Pre-protocol application		Immediately post protocol application		One month post protocol application		
	No.	%	No.	%	No.	%	
Extremely dissatisfied	6	17%	0	0%	0	0%	F = 51.04 P value < 0.001**
Dissatisfied	13	36%	0	0%	0	0%	
Satisfied to some extent	14	39%	0	0%	0	0%	
Satisfied	3	8%	10	28%	9	25%	
Extremely satisfied	0	0%	26	72%	27	75%	
<b>Total</b>	36	100%	36	100%	36	100%	
$\bar{x} \pm SD$	10.61 $\pm$ 7.22		25.09 $\pm$ 21.73		25.29 $\pm$ 22.66		

(\*\*) Significant result.

**Table 5: Correlation matrix among oncology nurses' age, experience, knowledge, competencies and patients' safety and satisfaction.**

Item	Oncology Nurses'				Patients'	
	Age	Experience	Knowledge	Competencies	Safety	Satisfaction
Nurses' Age	1.00					
Nurses' Experience	0.91**	1.00				
Nurses' Knowledge	0.80**	0.82**	1.00			
Nurses' Competencies	0.81**	0.87**	0.81**	1.00		
Patients' Safety	0.51	0.80**	0.92**	0.96**	1.00	
Patients' Satisfaction	0.41	0.90**	0.90**	0.92**	0.95**	1.00

(\*\*) Significant result.

## Discussion

In order to ensure safe chemotherapy administration, a competent oncology nurses play a variety of tasks in various organizations and clinical contexts. They must adjust and interpret guidelines for the practice environment and care providers. More patients can benefit from receiving chemotherapy at its full dose on schedule in accordance to nursing management standards, which also improve patient care, lessen practice variance, lower the risk of problems, and decrease readmissions of patients <sup>(22)</sup>. So this study aiming to evaluate the effect of chemotherapy nursing protocol application on patients' care competency, safety, and satisfaction.

**The first hypothesis was accepted** according to the study results as the total knowledge score increased immediately post protocol application and continued to be high. This may be related lack of knowledge refreshment and updating for nurses at oncology units and decreased numbers of educational program or even new protocols application. This result was supported by **Mohamed et al., (2021)** <sup>(23)</sup> who conducted a study with results indicated that, more than half of the studied nurses had unsatisfactory level of knowledge regarding reproductive cancer and chemotherapy before implementation of the protocol.

This result is also in the same line with the results of **El-seadi et al., (2020)** <sup>(24)</sup> who mentioned that there was highly significant improvement in overall knowledge among studied nurses' group at second month and post ending protocol of care compared to control group.

Also, the findings of the present study are consistent with those of **Nouri et al., (2021)** <sup>(25)</sup> which showed a statistically

significant increase in the knowledge and performance scores of oncology nurses both before and after the protocol application.

**On contrast** the results of the current study were versus results of **Taghizadeh Kermani et al., (2015)** <sup>(26)</sup> which reported that, there was statistically significant difference in mean scores of knowledges and attitudes before and after the course. This contrast may be due to the effect of participants' age and previous experiences. **As regarded to oncology nurses' clinical competency, the second hypotheses were accepted** as the current study revealed that the mean total practice competency score of studied nurses was increased immediately post protocol application and continued to be high at the follow up. This finding indicating that skills can be easily improved when linked to their relevant scientific knowledge base. The more excellence will be achieved with pre-service orientation program concerning safe high quality oncology patient care.

This result was in the same line with **Mohamed et al., (2021)** <sup>(23)</sup> results which revealed a statistically significant improvement in nurses' care quality and practical skills related to reproductive cancer and chemotherapy administration immediately post protocol application and after three month follow up phase.

The current study's findings also came in accordance with those of **Hojati, et al., (2023)** <sup>(27)</sup>, who discovered that the mean performance scores of participants before, right away after, and one month after the intervention were, respectively,  $(43.60 \pm 5.11)$ ,  $(51.78 \pm 3.15)$  and  $(52.88 \pm 3.06)$ , Over time, the mean nurses' performance score dramatically improved ( $P < 0.001$ ).

Moreover, the study third hypothesis was accepted as there were statistically significant differences among oncology nurses regarding all patient safety subscales throughout study phases except for teamwork between nurses within their unit, teamwork across units, staffing and hospital management support for patient. This may be related to their working as one person, hence reduce the chance of errors and maintain safe patient environment.

This was in accordance with Sharp et al., (2019)<sup>(28)</sup> results in almost all areas, with the exception of the dimension of cooperation within units, where they claim "teamwork within units" was ranked greatest and "staffing" was rated lowest in all four countries. Nurses from the Netherlands and the United Kingdom performed better than those from Estonia or Germany in terms of "communication openness," "frequency of events reported," and "non-punitive response to errors." Five of the twelve dimensions—general perception of patient safety, openness of communication, staffing, handoffs and transitions, and non-punitive response to errors are associated with the overall patient safety grade, and there are statistically significant differences between the nations in these relationships.

Also, the current study findings agreed with results of Bakrey and Waly (2022)<sup>(29)</sup> which revealed that there was a highly significant improvement in the level of knowledge and practice. Level of education was predicted to be the only independent variable that improved the level of post-test knowledge while there were no significant independent variables that considered as a predictor in the improvement of the post-test practice.

The insignificant improvement in the patient safety subscales as teamwork between nurses within their unit, teamwork across units, staffing and hospital management support for patient may be related to that protocol was designated to nurses level with lack of participation of the higher administrative level where it supported by Khan et al., (2017)<sup>(30)</sup> who concluded that the poor compliance of nurses with the safety measures were consistently associated with several barriers including the partial facility, multitasking and work pressure, insufficient knowledge and techniques, lack of awareness and wrong beliefs as well as insufficient in-service training.

The fourth hypothesis was accepted as, the total score of patients' satisfaction increased immediately after protocol application and continued to be high at one-month post protocol application. This reflects improved care competence, reduced patients harming chance and feelings of hazardous after protocols application. These results were in agreements with Mohamed et al., (2021)<sup>(23)</sup> who founded that more than half of studied patients were moderate satisfied, and more than one quarter were highly satisfied with nursing care they received by studied nurses post protocol application rather than pre protocol application. On contracts, these results were contradicted with Khan et al., (2017)<sup>(30)</sup> who reported that more than half of patients were unsatisfied with care rendered and less than half of patients were satisfied.

The current results stated a strong positive correlation among age, experience, knowledge competency and patient satisfaction. Because of age and experiences which were positively affected

on the knowledge level of nursing personnel. In the same line was **Mohamed et al., (2021)** <sup>(23)</sup> who confirmed the statistically highly significant positive relation between nurses' knowledge and nurses' practice and women's satisfaction post guidelines protocol application. Also, the current study findings came in agreement with **Shetaia et al. study, (2017)** <sup>(31)</sup> who founded that there was a significant correlation between total nurses' knowledge score and total practice competency score before implementing chemotherapy safety protocol where P values were found to be.

To sum up; The present study directed the attention for chemotherapy protocols application, utilization and distribution among all oncology nurses at different oncology institutions for improving nursing staff knowledge and practice competence which in turn will promote both patients' safety and satisfaction.

**Limitation of the study:** Restriction of the results generalizability because one hospital was the only source of the sample population.

#### **Conclusion**

As findings illustrate, following the implementation of the chemotherapy nursing protocol, significant improvements in oncology nurses' knowledge, clinical competency and patients' safety and satisfaction were seen. Additionally, there was tightly bound association of nurses' chemotherapy related knowledge and clinical competency with patients' safety and satisfaction.

#### **Recommendations**

##### **For nursing practice:**

- Application of chemotherapy nursing protocol is recommended routinely for managing all chemotherapy patients.
- A large-scale replication of the study is recommended.

##### **For nursing education:**

- In-service continuous updated developmental program should be periodically carried out for oncology nurses to advance their practice and reduce the complication's incidence.

##### **Acknowledgment:**

Honorable gratitude to all who participated in this study.

##### **References**

1. van Meurs J, Stommel W, Leget C, van de Geer J, Kuip E, et al. Oncologist responses to advanced cancer patients' lived illness experiences and effects: An applied conversation analysis study. *BMC Palliative Care*. 2022; 21(1): 37.
2. Friese C. R, Yang J, Mendelsohn-Victor K, Mccullagh M. C. Randomized controlled trial of an intervention to improve nurses' hazardous drug handling. *Oncology Nursing Forum*. 2019; 46(2): NIH Public Access.
3. Gunawan J, Aunguroch Y, Fisher L, Marzilli C, Liu Y. Factors related to the clinical competence of registered nurses: Systematic review and meta analysis. *Journal of Nursing Scholarship*. 2020; 52(6): 623-633.
4. Asefa, S., Aga, F., Dinegde, N. G., & Demie, T. G. Knowledge and practices on the safe handling of cytotoxic drugs among oncology nurses working at tertiary teaching hospitals in Addis Ababa, Ethiopia. *Drug, Healthcare and Patient Safety*. 2021: 71-80.

5. Andri L, Puspita S, Prastuti S. Nurses' perception of patient safety culture in the hospital accreditation era: A literature review. *Kne Life Sciences*. 2018; 60-75.
6. Alrabadi N, Shawagfeh S, Haddad R, Mukattash T, Abuhammad S, Al-rabadi D, et al. Medication errors: A focus on nursing practice. *Journal of Pharmaceutical Health Services Research*. 2021; 12(1): 78-86.
7. Schlichtig K, Dürr P, Dörje F, Fromm M. New oral anti-cancer drugs and medication safety. *Deutsches Ärzteblatt International*. 2019;116(46): 775.
8. Devi S, Sharma P, Kaur S, Banipal A. Knowledge and attitude regarding safe handling of chemotherapeutic drugs among nurses-a cross-sectional. *International Journal of Current Research*. 2019; 11: 6380-6386.
9. Uwayezu M, Nikuze M, Johanna A, Buswell L, Fitch M. Competencies for nurses regarding psychosocial care of patients with cancer in Africa: An imperative for action. *JCO Global Oncology*. 2022; 8: e2100240.
10. Rajesh S, Aashima A, Nanda M, Fronterre C, Sewagudde P, Ssentongo A, et al. "Mapping cancer in Africa: A comprehensive and comparable characterization of 34 cancer types using estimates. *GLOBOCAN*. 2022.
11. Alorabi M, Elghazawy H. Cancer control in Egypt: Investing in health. *The ASCO Post*. 2021.
12. Diab A, Abdallah K, Bingham C, Brogdon M, Dadu R, Ernstoff S. Developing and validating nursing care standard for patients receiving chemotherapy. Doctoral Thesis, Faculty of Nursing, Ain Shams University. 2010.
13. Al Salem G, Paul B, Jill M. Hospital survey on patient safety culture: Psychometric evaluation in Kuwaiti public healthcare settings. *BMJ open*. 2019; 9(5): e028666.
14. Reis C, Laguardia J, Vasconcelos A, Martins M. Reliability and validity of the Brazilian version of the hospital survey on patient safety culture (HSOPSC): A pilot study. *Cadernos De Saude Publica*. 2016; 32.
15. O'Donovan R, Ward M, De Brún A, McAuliffe E. Safety culture in health care teams: A narrative review of the literature. *Journal of Nursing Management*. 2019; 27(5): 871-883.
16. Sturm H. Do perceived working conditions and patient safety culture correlate with objective workload and patient outcomes: A cross-sectional explorative study from a German university hospital. *Plos One*. 2019; 14(1): e0209487.
17. Mardon E, Khanna K, Sorra J, Dyer N, Famolaro T. Exploring relationships between hospital patient safety culture and adverse events. *Journal of Patient Safety*. 2010; 6(4): 226-232.
18. Gambashidze N, Hammer A, Brösterhaus M, Manser T. Evaluation of psychometric properties of the German Hospital Survey on patient safety culture and its potential for cross-cultural comparisons: A cross-sectional study. *BMJ Open*. 2017; 7(11): e018366.
19. Alahmadi H. A. Assessment of patient safety culture in Saudi Arabian hospitals. *Quality and Safety in Health Care*. 2010; 19(5): e17-e17.
20. Hawthorne G, Janet S, Nick M. An update on the development of the short assessment of patient satisfaction. *SAPS*. 2009.
21. Puzanov I, Diab A, Abdallah K, Bingham C, Brogdon D, Ernstoff S. Managing



- toxicities associated with immune checkpoint inhibitors: Consensus recommendations from the society for immunotherapy of cancer (SITC) Toxicity Management Working Group. *Journal for Immunotherapy of Cancer*. 2017; 51: 1-28.
22. Given, J., Casson, K., Dolk, H., & Loane, M. Sociodemographic variation in prescriptions dispensed in early pregnancy in Northern Ireland 2010–2016. *Plos One*. 2022; 17(8): e0267710.
23. Mohamed M., A., Attia, A., Farouk, O. E., & Moustafa, E. Effect of nursing guideline on nurses' knowledge and practices regarding chemotherapy for women with reproductive cancer. *Egyptian Journal of Health Care*. 2021; 12(3): 956-967.
24. El-seadi A. W, Maria A. M, Ahmed R. E, El-Hay A, Seham A. Effect of implementing a protocol of nursing care on peripheral venous access complications for patients undergoing chemotherapy. *Tanta Scientific Nursing Journal*. 2020; 19(1): 120-151.
25. Nouri A, Seyed Javadi M, Iranijam E, Aghamohammadi M. Improving nurses' performance in the safe handling of antineoplastic agents: A quasi-experimental study. *BMC Nursing*. 2021; 20(1):1-5.
26. Taghizadeh A, Hosseini S, Salek R, Pourali L. Improving knowledge and attitude of nurses working in chemotherapy wards through a short educational course: A successful experience in Mashhad. *Future of Medical Education Journal*. 2015; 5(4): 10-13.
27. Hojati Z, Goudarzi F, Hasanvand S, Galehdar N, Birjandi M. The impact of training chemotherapy safety standards with a smartphone application on the knowledge, attitude, and performance of nurses. *BMC Nursing*. 2023; 22(1): 1-11.
28. Sharp L, Rannus K, Olofsson A, Kelly D, Oldenmenger W. H, Eonsreca N. Patient safety culture among European cancer nurses—An exploratory, cross-sectional survey comparing data from Estonia, Germany, Netherlands, and United Kingdom. *Journal of Advanced Nursing*. 2019; 75(12): 3535-43.
29. Bakry H, Eman W. Effectiveness of health education on safety measures for family caregivers of cancer patients receiving cytotoxic drugs. *Zagazig University Medical Journal*. 2022.
30. Khan M, Hassan R, Anwar S. Patient satisfaction with nursing care. *Rawal Medical Journal*. 2017; 32(1): 27-29.
31. Shetaia S, Shereif W, Omran E. Effect of nursing guideline on nurses' knowledge and practices regarding chemotherapy for women with reproductive. *Cancer Mansoura Nursing Journal (MNJ)*. 2017; 4(1): 267- 279. Available at: [https://mnj.journals.ekb.eg/article\\_176441\\_b0d0aee29613bc0c08114dd4c6e31fdf.pdf](https://mnj.journals.ekb.eg/article_176441_b0d0aee29613bc0c08114dd4c6e31fdf.pdf).