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## Obstacles' and Facilitators Facing Safe Administration of Chemotherapy by Oncology Nurses

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### Abstract

**Aim of the study:** This study aimed to determine obstacles' and facilitators facing safe administration of chemotherapy by oncology nursing staff.

**Material and methods: Study design:** descriptive study design (qualitative) was used. **Setting:** the study was conducted at Tanta cancer center affiliated to Ministry of Health at El Garbeia Governorate Egypt. **Sample: All** (55) nurses working in oncology medical department at Tanta cancer center and administer chemotherapy. **Tools:** five tools was used to conduct this study. **Tool one: Structured interview questionnaire:** It was developed by the research after review of related literature. It was consisted of two parts: **First part:** Socio-demographic characteristics of oncology nurses and **Second part:** Level of knowledge needed about cytotoxic chemotherapy) by nurses. The total responses was summed up and classified into three levels, high, moderate & Low. **Tool Two** Obstacles' facing nurses for safe administration of hazardous drug. It was developed by the researchers in Arabic & consisted of 13 open ended questions.

**Tool Three:** Modified Nurses attitude toward safe administration of hazardous drug for cancer patients (chemotherapy) questionnaire. It was adapted and translated into Arabic by the researchers. It was consisted of 18 items & included both positive and negative item statements **Tool Four:** Modified Nurses anxiety and fear to administer hazardous drug for cancer patient questionnaires. It was adapted and translated into Arabic by the researchers. It consists of 18 items, the responses were 4 response Statements. Total anxiety scores: divided into three levels high, moderate and low according to scores. **Tool Five:** Facilitators' of safe administration of hazardous drugs (cytotoxic chemotherapy): It was developed by the researchers in Arabic after review of related literature. It consisted of 13 open ended questions.

**Method: 1.** Permission was obtained from head of oncology department at main Tanta University Hospital. **2.** Ten experts in the field of oncology, five oncology experts affiliated to Faculty of Medicine Tanta University and five nurses revised the tool for content validity. **3.** Each nurses interviewed individually and participated to fulfill the questions in the five tools. **4.** Ethical considerations: Consent was obtained from nurses after explanation of the research study aims and content. Confidentiality of data was ensured using code number instead of their names and withdrawal from the study was reserved. **5.** Pilot study was carried out on 10% of the study sample 10 nurses working in outpatient clinics and administer chemotherapy and not included in the sample to test tool feasibility and applicability and the required modification was done.

**Results:** Oncology nurses age was from 21-55 and have years of experiences from 0-30 year and more than two third of them married with deplume of secondary school level of education with no training courses about safe chemotherapy administration. Obstacles' for safe chemotherapy administration as perceived by nurses working in oncology department and administer chemotherapy according to priority ranking related to patient and as well as nurses were the first priority while the last priority was related to hospital system of care delivery. Nurses attitude affect their behaviors to administer chemotherapy safely since slightly more than half 52% of nurses working in oncology had positive attitude toward safe administration of chemotherapy needed high level of knowledge and more than two third 76.36 % had moderate level of anxiety respectively and the more oncology nurses had positive attitude and more than two third 70.9% expressed they are in need to increased knowledge to be at high level the more they feel higher anxiety level to administer chemotherapy safely. Also facilitators for according to priority ranking, environmental factors especially quite wide space with sufficient illumination were the first priority followed by time of the shift and the last priority facilitors was hospital system.

**Conclusion and Recommendation Recommendations:** Strategies to improve medication safety also need to be targeted at specific multiple points in addition to oncology nurses attitudes and feelings toward safe chemotherapy administration which in respect shaping their behavior of cancer patients' care.

**Key words:** Safety, Drug administration, Chemotherapy, Nurses, Attitudes, anxiety, knowledge, Obstacles, Facilitators.

### INTRODUCTION

Cancer is a group of serious neoplastic diseases in which there is a transformation of normal body cells into malignant ones and abnormal cells divide without control and can invade nearby tissues & spread to other parts of the body. Worldwide an increasing number of people are living with cancer estimated almost 32.5 million people diagnosed with cancer were still alive at the end of 2012. World Health Organization declared that the number of new cases of cancer is expected to rise by about 70% over the next 2 decades. Also worldwide there will be an estimated 23.6 million new cases of cancer each year by the year 2030. More than four in ten cancers occurs around the world are in

countries with a low or medium level of human development. Globally approximately 70% of deaths from cancer occur in low to medium income countries. In Egypt the national cancer registry presents the rate of incidence of cancer cases was 114,985 in the year 2013. Population growth alone would increase the number of incidence cases by 55.2% in the year 2015. Also the number of cases will increase to 331.169 in the year 2050 [1-4].

**Chemotherapy medication administration safety** is a challenge facing all health care professional. Chemotherapy is one of the most common type of treatment modality prescribed for cancer patient. Medication errors prevention

is an important goal of nurses, pharmacists and physician in all treatment places especially in oncology. Medication errors harm at least 1.5 million patient every year in hospital as reported by institute of Medicare 2006. Also it causes 7000 death annually. Reduction of medication errors remain the mainstay of all health care professional to improve patient safety. In trying to understand why an error occurred, it is important to look for all the contributing factors, rather than the most obvious reason or at the end of the process [5].

**Challenges to patient safety grow as the number of cytotoxic chemotherapy broaden** Jacobson *et al*; (2009) [6]. Obstacles' and facilitator' of safe cytotoxic chemotherapy administration may be related to, patient, nurses knowledge, attitudes and anxiety & behaviors, environment, time, hospital system and chemotherapy itself. Obstacles' of safe chemotherapy administration are multiples and frequently multifactorial in nature. Often there is a combination of events that together result in patient harm. This is important to understand for a reason, is that chemotherapy administration errors are various types. It includes errors in classic administration & in monitoring. The classic administration errors are a drug being given to the wrong patient, by the wrong route, time, in the wrong dose or the wrong drug used. Not giving a prescribed drug is another form of administration error. These errors can result from inadequate communication, slips or lapses, lack of checking procedures, lack of vigilance, calculation errors and suboptimal workplace & medication packaging design & Inadequate documentation. There is often a combination of contributory factors Rothchild *et al* (2005) [7].

**Types of errors in medication monitoring are inadequate monitoring for side-effects; medication not ceased once course is complete or clearly not helping the patient; course of prescribed medication not completed; drug levels not measured, or measured but not checked or acted upon; communication failures due to nurses attitude which is defined as affective cognitive and behavioral response and tendency toward a mode of response toward the object & nurses anxiety which is multidimensional emotional state manifested by feeling of uneasiness and apprehension. This is a risk if the care provider changes, for e.g., if the patient moves from the hospital setting to the community setting or vice versa [7-11].**

**Chemotherapy preparation and administration is the pivotal role of oncology nurses** which demand specialist knowledge and skills as well as positive attitude. It affected by little errors, negligence or malpractice & may also influence, patients, staff and environment Considen *J et. al*; (2008) <sup>(12)</sup>. Also nurses had an important role in assessing and managing many of problems experienced by the patients undergoing chemotherapy. Because of the systemic effects on normal as well as malignant cells, these problems are often wide spread affecting many body systems. The local effects of chemo agent are also of concern. Extravasation must be observed by nurses because the risk of consequences increased during administration which may lead to necrosis especially with vesicant agents and this brought the attention of nurses and physician to provide corrective measures. Because of potential hazards associated with chemotherapy specific precaution involved preparation

and administration of chemotherapy had developed by oncology nursing society, Roe & Lennan(2014) [13], Brunner's and Suddarth (2014) [14]. There has been only limited and no recent investigation of the preparation of nurses in the provision of cancer care Edward *et. al*; (2016) [15]. So this study was done to investigate preparation of nurses for the provision of chemotherapy preparation and administration & to determine obstacles' and facilitators of safe administration of chemotherapy as reported by oncology nurses.

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

This study aimed to determine obstacles' and facilitators facing oncology nursing staff for safe administration of chemotherapy

### **Research questions:**

1. What are obstacles' and facilitators facing oncology nursing staff for safe administration of chemotherapy?
2. Is there a relation between nurses demographic characteristics and obstacles' facing them for safe chemotherapy administration ?
3. Is there a relation between obstacles' and nurses safe administration of chemotherapy ?

### **MATERIALS AND METHOD**

**Study design:** descriptive study design (qualitative) was used .

**Setting:** the study was conducted at inpatient medical department of Tanta cancer center affiliated to Ministry of Health at El Garbeia Governorate, Egypt.

**Sample:** All nurses working in oncology inpatient medical department (55) at Tanta cancer center and administer chemotherapy.

**Tools:** four tools concerned with obstacles' and facilitators to safe hazardous drug administration to cancer patients was used to carry out this study.

#### **Tool one: Structured interview questionnaire:**

It was developed by the research after review of related literature. It was consisted of two parts: Socio-demographic characteristics of oncology nurses and Level of knowledge needed about hazardous drugs as follows.

#### **First part: Demographic characteristics' of nurses:**

It included demographic characteristics of nurses such as age, occupation years of experience, education level, training courses. It was developed by the researcher after review of relevant literatures <sup>(1-10)</sup>. Cronbach's Alpha was done on pilot study of ten nurses working in outpatient clinics and administer chemotherapy and not included in the study sample: Socio-demographic data = 0.764 (Interclass correlation single measures= 0.220, P=0.006\*).

#### **Second part: Level of knowledge needed about hazardous drugs by nurses:**

It was concerned with level of knowledge needed by nurses about chemotherapy drugs, effects, side effects and administration. It was consisted of (6) closed ended questions.

### **The scoring system**

If the response was yes allotted score two.

If the response was no allotted score one.

**Total scores of needed knowledge:** Range (6-12)

The total responses was summed up and classified into three levels:

Low level of needed knowledge if the total scores was (<50%) and range of (6-8).

Moderate level of needed knowledge if total scores was (50-75%) & range of (9-10).

High level of needed knowledge if the total scores was (>75%) & range of (11-12).

**Tool Two: Obstacles' facing nurses for safe administration of hazardous drug (cytotoxic chemotherapy).** It was developed by the researchers in Arabic & after review of related literature <sup>(1-20)</sup>. It consisted of (13) open ended questions.

#### **The Scoring System:**

The questions was ranked according to priority into three ranks from (1-3), since the first priority ranked item was allocated score one while the least was allocated score three.

**Tool Three: Modified nurses attitude toward safe administration of hazardous drug (cytotoxic chemotherapy) for cancer patients item statements'.**

It was developed by Verity (2005) [16] and adapted (modified) and translated into Arabic by the researcher. It was consisted of 18 items. The attitude statements' included both positive and negative item statements on a four point likert scale. The positive and negative statements as follows. The positive statements were 1,3,6,8,9,11,12, 17,18 . and The negative statements were 2,4,5,7,10,13,14,15,16.

Positive attitude statements were scored (4) strongly agree,(3) agree, (2) disagree, (1) strongly disagree and conversely negative attitude item (1) strongly agree, (2) agree, (3) disagree, (4) strongly disagree. the highest possible total score would be 72 pointing a positive attitude. The direction of scoring on likert scale was not included on the questionnaire administered to the nurses.

**The scoring system: Total attitude scores Range (18-72) .**

**Total attitude score level:** it was divided into two levels according to the following:

It was considered Negative attitude if the total score was (<60%) and range of (18-50). It was considered Positive attitude if the total score was  $\geq$ 60%) and range (51 -72).

**Cronbach's Alpha** was done on pilot study of ten nurses working in outpatient clinics and administer chemotherapy and not included in the study sample was for Attitude scale= 0.802 (Interclass correlation single measures= 0.209, P=0.036\*).

#### **Tool Four:**

**Modified Nurses anxiety and fear to administer hazardous drug for cancer patient questionnaires.** It was developed by, Verity (2005) [16] and adapted and translated into Arabic by the researchers.

**The Scoring System:** It consists of 18 items **Statements**, the responses were 4 responses; a 4 point likert scale was used

and the highest possible score indicating lower level of anxiety.

#### **Scoring system for anxiety scale:**

Always was allocated score one, often score 2, never score 4, on occasion / at once/soon score 3. The total score was 72, the higher score indicates low level of worries / anxiety and the lowest score indicates higher level of anxiety / worries.

**Total anxiety scores:** Range (18-72)

**Total anxiety level:** it was divided into three levels according to the following:

**High anxiety:** if the total score was (<50%) & range (18-44)

**Moderate anxiety:** if the total score was (50-75%) & range (45-58)

**Low anxiety:** if the total score was (>75%)& range (59-72)

**Cronbach's Alpha** was done on pilot study of ten nurses working in outpatient clinics and administer chemotherapy and not included in the study sample was for Modified Anxiety scale= 0.877 (Interclass correlation single measures= 0.285, P=0.0001\*)

**Tool Five: Facilitators' of safe administration of hazards drugs (cytotoxic chemotherapy) :** It was developed by the researchers in Arabic after review of related literature <sup>(1-20)</sup>. It consisted of (13) open ended questions

#### **The Scoring System:**

The questions was ranked according to priority into six total ranks from (1-6), since the first priority ranked item was allocated score one while the least was allocated score six and subareas was divided into three ranks allotted score from 1-3 since the highest priority rank was allocated score one and the least allocated score 3 .

#### **Method:**

1. Permission was obtained from head of oncology department at Tanta cancer center affiliated to ministry of health in Egypt .
2. **Tools development :** *Tool one & two* was developed by the researchers in Arabic & after review of related literature .*Tool Three & Four* was developed by Verity (2005) [16] and adapted (modified) and translated into Arabic by the researchers. *Tool Five* was developed by the researchers in Arabic after review of related literature
3. **Content validity** of the tools: Ten experts in the field of oncology, five oncology experts affiliated to Faculty of Medicine Tanta University and five nurses revised the tool for content validity.
4. Each nurse interviewed individually to maintain individual differences among the professionals and participated to fulfill the questions in the five tools.
5. Confidentiality and anonymity of data was ensured using code number instead of their names and withdrawal from the study was reserved.
6. Ethical considerations: Consent was obtained orally from nurses after explanation of the research study aims and content.
7. Pilot study was done on 10% of the sample and represented by 10 nurses working in outpatient clinics and administer chemotherapy and not included in the

study sample to test applicability and consistency and the necessary modification and Cronbach's Alpha was done.

8. Computerized program SPSS version18 software was used to analyze data.
9. Limitation of the study: Generalizability of the this study results need to be tested in other institutions and countries.

## RESULTS

**Demographic data of the studied nurses administering cytotoxic chemotherapy for cancer patients.** The age of nurses was range from 21-55 year with Mean±SD 35.81±9.16 and had experiences years was from range from 0-30 years with Mean±SD. Also majority 83.6%, 80.0% , 76.4%, 76.9% of nurses were married & educated in technical secondary school with deplume level with no training courses and most of who was received training courses were trained one time respectively. Further more than two third of studied nurses 76.4% works in Chemotherapy department.. Majority of studied nurses 83.6%, 83.6% were studying about administration of cytotoxic chemotherapy generally and were received no Training about administration of cytotoxic chemotherapy, 90.9 % of nurses were studying about administration of cytotoxic chemotherapy as a part of studying curriculum respectively. Also all 100% of oncology nurses were obtained insufficient knowledge about administration of cytotoxic chemotherapy and near all 96.4 & slightly more than two third 67.3% of oncology nurses working in chemotherapy administration were need more references about administration of cytotoxic chemotherapy and need more information about administration of cytotoxic chemotherapy respectively.

**Table (1) Agreement of the studied oncology nurses about ranking obstacles' facing safe administration of cytotoxic chemotherapy.** This table revealed that all 100% of the studied on nurses administering cytotoxic chemotherapy were ranked the following factors as at the highest factors that impede safe administration of chemotherapy , unstable patient condition or deteriorated pre & during administrating chemotherapy, chemotherapy side effects as sensitivity or extravasation, abnormal laboratory investigations results as abnormal blood cell count, liver & kidney functions, and blood chemistry, pregnant nurse , inadequate nurses staffing in relation to increased number of patients and medication prescription charts or records are not clear respectively .

Also it was found that the highest ranked factors and its related sub-items were related to patient and its sub-items as well as three sub-items of factors related to nurses while only one sub-items related to health care delivery system was ranked as highest factor was ranked one followed by three sub-items related to health care delivery system was ranked score two and one sub-items ranked score three in health care delivery system and another one sub-items of factors related to nurses ranked score 4.

**Table (2) illustrates needed knowledge items among the studied nurses about cytotoxic chemotherapy administered for cancer patients.** The highest ranked

priority of needed knowledge by oncology nurses in chemotherapy administration was psychological and emotional care of cancer patients and their relatives followed by administration of cytotoxic chemotherapy and the third priority of needed knowledge about best use of equipment on administering chemotherapy followed by side effects of cytotoxic chemotherapy, extravasations' as a side effect of cytotoxic chemotherapy and the lowest ranked priority of needed knowledge was Effect of administering chemotherapy on patients rooms in hospital.

**Table (3) shows levels and mean total scores of needed Knowledge about cytotoxic chemotherapy administered for cancer patients among the studied oncology nurses.** It was found that knowledge highly needed in more than two third 70% of studied oncology nurses with score range (11-12) , Mean±SD10.98±1.58.

**Table (4) Attitude of the studied oncology nurses towards cytotoxic chemotherapy administered for cancer patients.** Slightly more than half 52.7% of studied oncology nurses have Positive attitude level score toward chemotherapy with score ranged 51-72 while negative score was found to be in less than half 47.3 % of them .Also it was found that total score ranged between 18- 72 with Mean±SD50.73±2.39.

**Figure (1) illustrates relationship between levels of total needed knowledge and levels of total attitude among the studied nurses about cytotoxic chemotherapy administered for cancer patients.** It was found that low levels of knowledge needed among majority 81.8% of the studied oncology nurses with negative attitude while near two third 59.0% of the studied nurses with high levels of needed knowledge have high positive levels of total attitude. Also this figure revealed that majority 80.0% of studied oncology nurses with moderate needed level of knowledge have positive attitude.

**Table (5) presents Levels and mean scores of Modified anxiety scale among the studied oncology nurses about cytotoxic chemotherapy administered for cancer patients (n=55).**This table revealed that moderate anxiety level was felt in more than two third 76.4 % of the studied nurses administering cytotoxic chemotherapy for cancer patients. Also it was found that total anxiety scores were ranged 43-63 with Mean±SD53.45±2.84.

**Figure (2) illustrates relationship between levels of total needed knowledge and levels of total anxiety among the studied nurses about cytotoxic chemotherapy administered for cancer patients.** It was found that more than two third 66.7% of oncology nurses with low levels of total needed knowledge have moderate anxiety levels while equal percentage 16.7%, 16.7% of them have high and low levels of total anxiety. Concerning the relation between moderate total level of needed knowledge among studied oncology nurses and total level of anxiety it can be seen that all 100% of them have moderate total levels of needed knowledge & at 90. % of total anxiety level .Also it was found that oncology nurses with high levels of total needed knowledge have moderate total anxiety level in

more than two third 68.2% while none of them have low levels of total anxiety.

**Figure (3) illustrates relationship between levels of total attitude and total anxiety among the studied oncology nurses about cytotoxic chemotherapy administered for cancer patients .** It was found that in the studied oncology nurses with positive attitude, majority 89% of them have moderate anxiety level while minority of percentage 6.9% , 3.4 % have high and low anxiety level respectively.

**Table (6) Relationship between levels of total needed knowledge, attitude and anxiety among the studied oncology nurses about cytotoxic chemotherapy administered for cancer patients.** It can be seen that majority 81.8% of low level of total needed knowledge of the studied nurses have negative attitude while majority 80.0%of moderate level of total needed knowledge have positive attitude. Also it was found that all of moderate needed knowledge of the studied nurses have moderate anxiety and majority 90.9 % of low needed knowledge of studied nurses have moderate Level of total Modified anxiety scale while more than quarter of nurses with high level of needed knowledge have low level of anxiety. High anxiety levels was found among minority 9.1 % of studied nurses with low level of needed knowledge and even with no low level of anxiety.

**Table (7) shows relationship between levels of total needed knowledge and levels of total attitude and anxiety among the studied nurses about cytotoxic chemotherapy administered for cancer patients.** It can be seen that majority 81.8% of low level of total needed knowledge of the studied nurses have negative attitude while majority 80.0%of moderate level of total needed knowledge have positive attitude. Also it was found that all oncology nurses with moderate needed knowledge have moderate anxiety and majority 90.9 % of low needed knowledge of studied nurses had moderate Level of total Modified anxiety. High anxiety levels was found among minority 9.1 % of studied nurses with low level of needed knowledge and even with no low level of anxiety.

Moreover it was found that significant relation between levels of total attitude towards chemotherapy and levels of total needed knowledge of the studied nurses about cytotoxic chemotherapy for cancer patients  $\chi^2 =7.369$  at P value =0.025. No statistical significant difference between and the level of total modified anxiety level among studied nurses  $\chi^2 = 6.648$  at P value =0.156.

**Figure (4): Correlation between total scores of needed knowledge and scores of total attitude and anxiety among the studied nurses about cytotoxic chemotherapy administered for cancer patients (n=55).** Significant linear relation was found between oncology nurses total score of needed knowledge and attitude and anxiety (r=0.358 at P=0.007\* and r= 0.392 at P=0.003\*) respectively.

**Table (8) illustrates correlation between total scores of needed knowledge and scores of total attitude and anxiety among the studied oncology nurses about cytotoxic chemotherapy administered for cancer patients and their age and experiences.** It was noticed that positive correlation between total attitude scores and total scores of needed knowledge as well as total anxiety scores and total needed knowledge since r=0.283 at p value = 0.037 and r=0.385 at p value =0.004 respectively. Also this table illustrates none statistical significant correlation were found among the studied nurses age and years of experience with total scores of needed knowledge, attitude and anxiety at p value =0.894, 0.093, 0.369, 0.538, 0.199and 0.199 respectively.

**Table (9) shows facilitators of safe administration of cytotoxic chemotherapy among the studied nurses.** The highest ranked sub-items of facilitators to safe administration of cytotoxic chemotherapy as reported by the studied nurses were wide place with sufficient illumination and quite ranked number one, followed by second and third ranked which is Morning time and Established laws for treatment priority followed by seven sub-items four of them related to environment and two sub-items related to the hospital discipline .

Table (1): Agreement of the studied oncology nurses about obstacles" facing safe administration of cytotoxic chemotherapy (n=55).

Obstacles" facing safe administration of cytotoxic chemotherapy	Agreement of the studied nurses administering cytotoxic chemotherapy (n=55)		
	N	%	Rank
<b>Related to patient</b>			
-Unstable patient condition or deteriorated pre & during administrating chemotherapy	55	100	1
-Abnormal laboratory investigations results as abnormal blood cell count, liver & kidney functions, and blood chemistry	55	100	1
-Poor IV cannula	55	100	1
<b>Related to chemotherapy side effect</b>			
-Chemotherapy side effects as sensitivity or extravasation	55	100	1
<b>Related to environment</b>	53	96.4	2
Crowdness of patients in drug administration room			
Lack in number of beds & rooms and small size room and insufficient equipment	51	92.7	3
<b>Related to hospital system</b>	55	100	1
Medication prescription charts or records are not clear			
-Delayed laboratory investigations results in accurate time	53	96.4	2
-No written consent taken from patients and patient not oriented about chemotherapy	53	96.4	2
<b>Related to nurses</b>	55	100	1

-Pregnant nurse			
-Inadequate nurses staffing in relation to increased number of patients	55	100	1
-Lack in number of qualified nurses and nurses knowledge	50	90.9	4

Table (2): Items of knowledge needed among the studied oncology nurses about cytotoxic chemotherapy administered for cancer patients (n=55).

Items of knowledge needed	The studied nurses administering cytotoxic chemotherapy for cancer patients (n=55)		Rank of need priority
	N	%	
<b>1. Side effects of cytotoxic chemotherapy:</b> No Yes	11 44	20.0 80.0	4
<b>2. Extravasation as a side effect of cytotoxic chemotherapy:</b> No Yes	11 44	20.0 80.0	4
<b>3. Administration of cytotoxic chemotherapy:</b> No Yes	5 50	9.1 90.9	2
<b>4. Psychological and emotional care of cancer patients and their relatives:</b> Yes	55	100	1
<b>5. Best use of equipment on administering chemotherapy :</b> No Yes	10 45	18.2 81.8	3
<b>6. Effect of administering chemotherapy on patients rooms in hospital :</b> No Yes	19 36	34.5 65.5	5

Table (3): Levels and mean total scores of Knowledge needed about cytotoxic chemotherapy administered for cancer patients among the studied nurses (n=55).

Total needed Knowledge about chemotherapy	The studied nurses administering cytotoxic chemotherapy for cancer patients (n=55)	
	N	%
<b>Levels of total needed knowledge:</b>		
<b>Low</b> (<50%) (6-8)	11	20.0
<b>Moderate</b> (50-75%) (9-10)	5	9.1
<b>High</b> (>75%) (11-12)	39	70.9
<b>Total scores of needed knowledge:</b>		
Range (6-12)	8-12	
Mean±SD	10.98±1.58	

Table (4): Attitude of the studied oncology nurses towards cytotoxic chemotherapy administered for cancer patients (n=55).

Attitude towards chemotherapy	The studied nurses administering cytotoxic chemotherapy for cancer patients (n=55)	
	N	%
<b>Total attitude level:</b>		
<b>Negative</b> (<60%) (18-50)	26	47.3
<b>Positive</b> (≥60%) (51-72)	29	52.7
<b>Total attitude scores:</b>		
Range (18-72)	44-56	
Mean±SD	50.73±2.39	

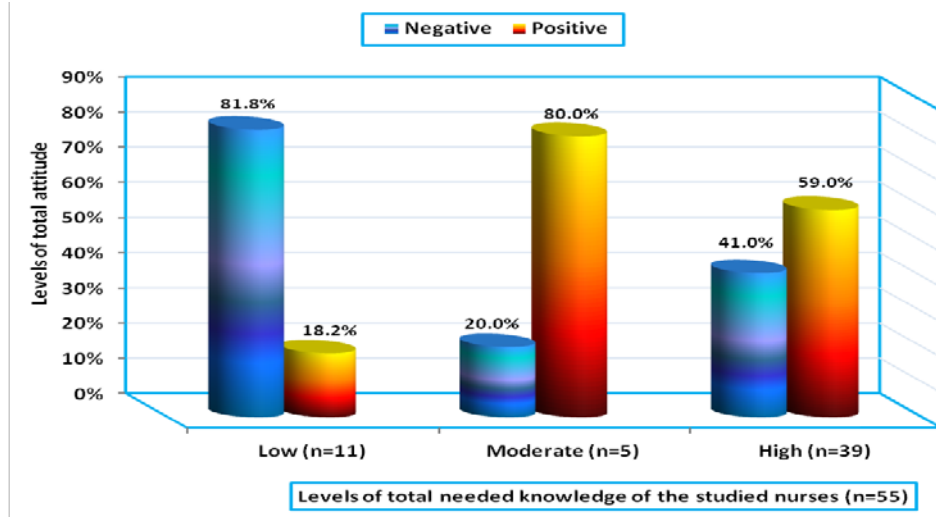


Figure (1): Relationship between levels of total needed knowledge and levels of total attitude among the studied nurses about cytotoxic chemotherapy administered for cancer patients (n= 55) .

Table (5): Levels and mean scores of Modified anxiety scale among the studied oncology nurses about cytotoxic chemotherapy administered for cancer patients (n=55).

Modified anxiety scale			The studied nurses administering cytotoxic chemotherapy for cancer patients (n=55)	
			N	%
<b>Total anxiety level:</b>				
High anxiety	(<50%)	(18-44)	2	3.6
Moderate anxiety	(50-75%)	(45-58)	42	76.4
Low anxiety	(>75%)	(59-72)	11	20.0
<b>Total anxiety scores:</b>				
Range		(18-72)	43-63	
Mean±SD			53.45±2.84	

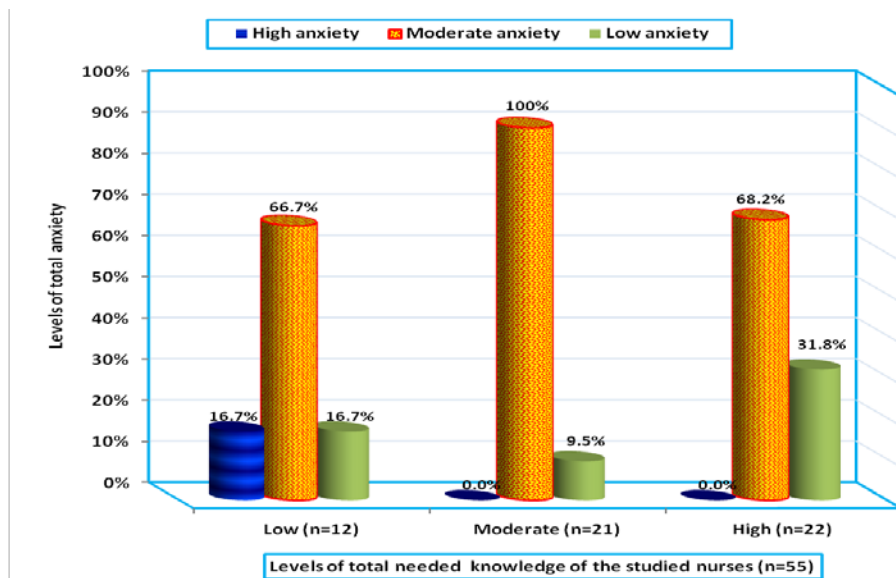


Figure (2) relationship between levels of total needed knowledge and levels of total anxiety among the studied oncology nurses about cytotoxic chemotherapy for cancer patients (n=55).

Table (6) : Relationship between levels of total needed knowledge and levels of total attitude and anxiety among the studied oncology nurses administer cytotoxic chemotherapy for cancer patient about cytotoxic chemotherapy (n=55).

Knowledge items	Levels of total needed knowledge of the studied nurses about cytotoxic chemotherapy for cancer patients (n=55)						$\chi^2$	P
	Low (n=11)		Moderate (n=5)		High (n=39)			
	N	%	N	%	n	%		
<b>Levels of total attitude towards chemotherapy:</b>								
Negative	9	81.8	1	20.0	16	41.0	7.369	0.025*
Positive	2	18.2	4	80.0	23	59.0		
<b>Level of total Modified anxiety scale:</b>								
Low worry or anxiety	0	0	0	0	11	28.2	6.648	0.156
Moderate anxiety	10	90.9	5	100	27	69.2		
High worry or anxiety	1	9.1	0	0	1	2.6		

\*Significant (P<0.05)

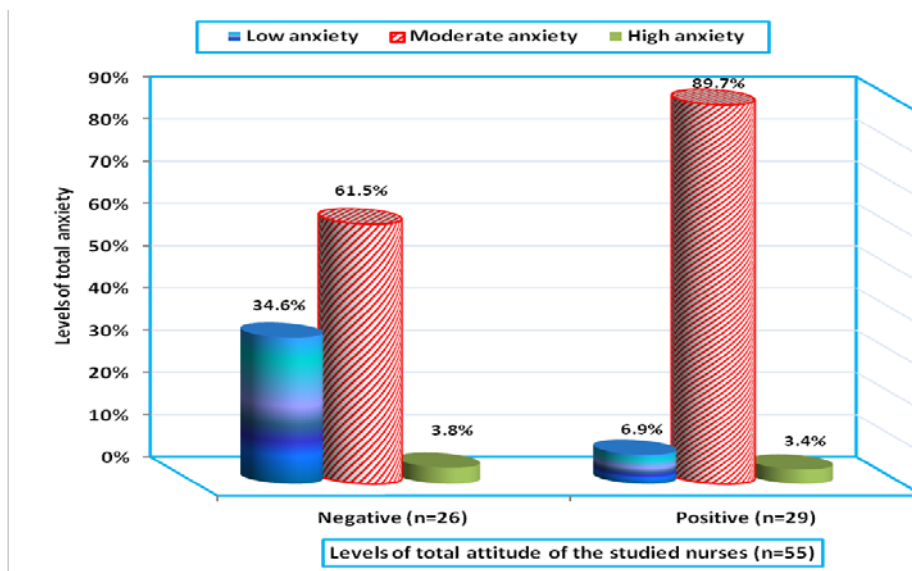


Figure (3) : Relationship between levels of total attitude and total anxiety among the studied oncology nurses about cytotoxic chemotherapy (n=55).

Table (7): Correlation between total scores of needed knowledge and scores of total attitude and anxiety among the studied nurses about cytotoxic chemotherapy administered for cancer patients, age and experiences (n=55).

Variables	Total scores of needed knowledge, attitude and anxiety of the studied nurses about cytotoxic chemotherapy for cancer patients (n=55)					
	Total scores of needed knowledge		Total attitude scores		Total anxiety scores	
	R	P	R	P	R	P
Total attitude scores	0.283	0.037*	-			
Total anxiety scores	0.385	0.004*	0.224	0.100		
Age years	0.018	0.894	0.229	0.093	0.124	0.369
Experience years	0.085	0.538	0.176	0.199	0.145	0.290

\*Significant (P<0.05)

r=Correlation Coefficient



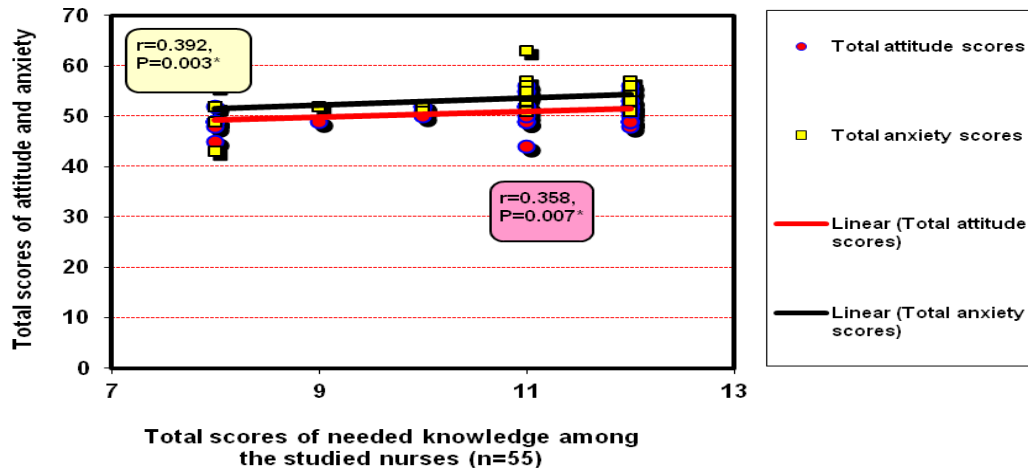


Figure (4): Correlation between total scores of needed knowledge and scores of total attitude and anxiety among the studied nurses about cytotoxic chemotherapy administered for cancer patients (n=55).

Table (8): Mean total scores of needed knowledge, attitude and anxiety among the studied nurses administering cytotoxic chemotherapy in relation to their demographic data (n=55).

Variables	Mean scores of total needed knowledge, attitude and anxiety among the studied nurses administering cytotoxic chemotherapy in relation to demographic data (n=55)					
	Total scores of needed knowledge	t-test of F value P	Total attitude scores	t-test of F value P	Total anxiety scores	t-test of F value P
	Mean±SD		Mean±SD		Mean±SD	
<b>Age years:</b>						
20-<30	10.67±1.76	1.662	50.00±2.30	2.615	53.93±3.01	0.198
30-<40	11.43±1.29	0.187	51.14±1.98	0.061	53.28±3.26	0.897
40-<50	10.47±1.81		50.20±2.73		53.20±2.14	
50-55	11.75±0.50		53.25±1.89		53.50±3.00	
<b>Marital status:</b>						
Single	10.57±1.90	1.275	49.57±1.40	1.003	53.57±2.07	0.148
Married	11.11±1.51	0.288	50.87±2.52	0.374	53.39±2.96	0.863
Widow	9.50±2.12		51.50±0.71		54.50±3.53	
<b>Department:</b>						
Chemotherapy department	10.98±1.55	0.047	50.74±2.51	0.060	53.36±3.00	0.454
Chemotherapy outpatient	11.00±1.73	0.963	50.69±2.06	0.953	53.77±2.31	0.652
<b>Experience years:</b>						
0-<10	10.84±1.64	1.189	50.21±2.20	0.679	54.05±2.86	0.641
10-<20	11.38±1.36	0.313	51.04±2.08	0.511	53.09±3.19	0.531
20-30	10.60±1.76		50.93±3.01		53.20±2.30	
<b>Education level:</b>						
Diploma in nursing	11.04±1.52	0.593	50.70±2.38	0.140	53.34±3.06	0.590
Bachelor of nursing	10.73±1.85	0.555	50.82±2.56	0.889	53.91±1.76	0.558
<b>Training courses:</b>						
No	10.95±1.54	0.246	50.38±2.40	1.982	53.33±3.14	0.565
Yes	11.08±1.75	0.807	51.85±2.07	0.053	53.85±1.57	0.574
<b>If yes, No. of training courses:</b>						
One	11.20±1.69	0.446	52.40±1.90	1.951	54.00±1.63	0.627
Two	10.67±2.31	0.664	50.00±1.73	0.077	53.33±1.53	0.543

Table (9): Facilitators of safe administration of cytotoxic chemotherapy among the studied oncology nurses (n=55).

Facilitators of safe administration of cytotoxic chemotherapy as perceived by oncology nurses	The studied nurses administering cytotoxic chemotherapy for cancer patients (n=55)			
	n	%	Rank of sub-items	Total rank
<b>1-Environment factors:</b>				
-Wide place with sufficient illumination and quite	6	10.9	1	1
-Sufficient number of rooms	3	5.5	2	4
-Sufficient and suitable number of beds	3	5.5	2	4
-Available utensils, tools and devices	3	5.5	2	4
-Increased number of efficient nurses	3	5.5	2	4
-Available needed treatment drugs and fund for it	2	3.6	3	5
<b>2-Time factor:</b>				
-Morning time	5	9.1	1	2
- Alnobtjah time	1	1.8	3	6
-Evening time	3	5.5	2	4
-The suitable time	1	1.8	3	6
<b>3-The hospital discipline:</b>				
-Established laws for treatment priority	4	7.3	1	3
-Suitable discipline	1	1.8	2	6
-The hospital routine easy and not disabling	1	1.8	2	6

## DISCUSSION

**Oncology nurses play crucial role in safe medication administration** especially cytotoxic chemotherapy. In the current study the nurses had experiences years were range from zero to thirty years ,married & educated in technical secondary school with deplume level with most of them with no training courses about administration of cytotoxic chemotherapy and minority had received one time training. Also all oncology nurses were obtained insufficient knowledge & were need more information, practical skills & references about administration of cytotoxic chemotherapy.

This current study findings in agreement with **Kosegroglu et al ; (2006) [17] & Krishnasamy et., al [18]** results revealed that minority of Turkish nurses had received in-service education about chemotherapeutics. The current study findings contradicted with results of **Gibson (2013) [19]** study mentioned that most of the participants were educated to at least bachelor's degree level. Only slightly more than half percent of respondents nurses had formal training in oncology, although four others reported alternative training consistent with specialist recognition such as Oncology Nursing Certification .

**Nurses were asked in the current study questionnaires' how they consider their own knowledge level** about chemotherapy administration only minority answered their knowledge level is great . Nurses who had poor knowledge were emphasized they are in need for high level of knowledge and hands on training. This is in agreement with literature findings which consider it is basic to improve nurses knowledge to help in reduction of medication errors and provide safe medication administrations. A signal that is encouraging concerns , the majority of nurses emphasize it is very important to improve their knowledge about preparation and administration of chemotherapy **Abd El Magid (2012) [20]**.

**Similar to findings of Abbasy (2013 ) [21], Gauski (2016) [22] studies results** the current study highlights that majority of nurses working in oncology be aware that

sufficient knowledge on chemotherapy preparation and administration is basic for reduction of medication errors as well as safe administration. The same approach was taken by oncology nurses who want to work as a professional oncology nurse. They must provide nursing practice which demand specific essential cancer knowledge and applied their clinical experiences beyond that acquired in a fundamental nursing program. Also Lack of information of nurses and a high level of interest for specific education and hands on training was reported by majority of oncology nurses in the current study. **Esmail et al ; [23]** Knowledge is the corner stone in provision of safe nursing care practices especially in the field of cancer nursing care since deficits in nurses knowledge may inversely affect safety of both patient and nurses.

**In relation to agreement of the studied oncology nurses about ranking obstacles' facing safe administration of cytotoxic chemotherapy.** All of the studied oncology nurses administering cytotoxic chemotherapy were ranked the following as the highest obstacles' that impede safe administration of chemotherapy , unstable patient condition or deteriorated patient condition pre & during administrating chemotherapy , chemotherapy side effects as sensitivity or extravasation , abnormal laboratory investigations results as abnormal blood cell count, liver & kidney functions, and blood chemistry, pregnant nurse, inadequate nurses staffing in relation to increased number of patients and medication prescription charts or records are not clear respectively.

**In the current study , it was found that the highest ranked obstacles'' and its related sub-items were related to patients and its sub-items .**Patients related obstacles was ranked number one followed by three sub-items related to health care delivery system was ranked score two and one sub-items ranked score three in health care delivery system.

**The current study finding in line with studies [ 7,19,24] indicated obstacles' related to patient ,**includes unstable patient condition or deteriorated pre & during administration of chemotherapy, abnormal laboratory investigations results as abnormal blood cell count, liver & kidney functions, and blood chemistry. Patient on multiple medications; patients

with a number of medical problems; patients who cannot communicate well, e.g. unconscious, people who do not speak the same language as the staff; patients who have more than one doctor prescribing medication; patients who do not take an active interest in being informed about their own health and medicines; adults (drug dose calculations required). Also these studies indicated that, medication errors may occur as a result of complexity of patient clinical status, medication prescription, number of prescribed medication, frequent changes of prescribed medication and patient attitudes and belief.

**Medication administration represents forty percent of nurses' clinical activities.** Although medication errors can occur at any time in medication management. It represents seventy eight percent of clinical errors and every day the patient experience on average one point seventy five percent errors as mentioned by **Rothschild JM et al**; [7].

**Obstacles' facing safe administration of chemotherapy to cancer patient related to cytotoxic chemotherapy itself** in the current study as confirmed in other study e.g. chemotherapy side effects e.g. sensitivity or extravasation as well as chemotherapy medication design such as look-a-like, sound-a-like medication for example ambiguous labeling different preparations or dosages of similar medication may have similar names or packaging such as usual release, slow release, delayed release or long acting medications may be differentiated by a suffix e.g. LA, ER. In fact, there are several different suffixes with the same properties **Kloth (2010) [25]**.

**Concerning workplace design obstacles' of safe chemotherapy administration**, in the current study it was lack of easy design to use for storage of medication and interruption during administration. This in line with **Carayon (2007) [26]**, **Palse (2009) [27]**, **Polovich (2012) [28]** studies recorded an interruption during drugs preparation and administration and environmental factors such as loud noises, poor lighting and untidy working area contribute to unsafe preparation and administration of chemotherapy. Also the highest interruption lead to errors is nurses phone call.

**One of the important obstacles' affecting oncology nurses to administer chemotherapy safely** were some nurses developed negative attitude toward administration of chemotherapy and they in need for more high level of knowledge in the current study. This is in line with **Muzio study(2016) [29]** findings indicated that little is known about knowledge, attitudes and professional of nurses toward prevention of errors of medication and highlight that eighty percent of nurses aware that appropriate knowledge on medication dose is essential to reduce medication errors. Also **Koceja (2003) [30]**, **Rinke (2007) [31]** studies reports that there is a gap between nurses knowledge and their actual behavior during administration of chemotherapy. **Kosegroglu et. al; (2006) [17]** pointed out that Turkish nurses showed that their actual administration method insufficient according their level of information and minority of them use safety cabinet during preparation and hospital should provide sufficient equipment and policy.

**Regarding obstacles' of safe chemotherapy administration related to nurses.** In the current study three sub-items of obstacles' related to nurses and another one sub-items of obstacles' related to nurses ranked score four. These obstacles include ,nurses knowledge, attitude, anxiety or fear to administer chemotherapy, pregnant nurse, inadequate nursing staff in relation to increased number of patients and inability to communicate well either with patients or their family. This in agreement with **Palse (2009) [27]**, **Valentine study (2013) [32]** results pointed out that, the obstacles includes lack of awareness about chemotherapy administration safety among health care providers in the work such as inexperience; rushing, emergency situations; multitasking; interruption during performing work; fatigue, boredom, vigilance and checking and double-checking habits deficits; poor teamwork, poor communication among the team; reluctance to use memory aids.

**Worldwide safe administration of hazardous drugs was instituted but until now there** are many well-known malpractices occurs. In the current study about half of nurses reported that the lack of safety guidelines and training program at their work place considered obstacles facing safe chemotherapy administration. This is confirmed by research **Kikase (2011) [33]** study findings revealed that incompetency in practice and poor level of knowledge of nurses' administering chemotherapy. Also this finding in line with **Orujulus (2016) [34]** study findings which revealed that slightly more than half and one of nurses reported that lack of safety guidelines and training programs at their workplaces respectively.

**The current study in line with the findings of the study by Khan et al ; (2012) [35]** indicated that oncology nurses had poor knowledge and skills. Unsafe chemotherapy administration considered especially when nurses had no updated and advanced knowledge and not competent in skills of administration. Nursing skills were weak in all three stages pre, during and post chemotherapy administration. Nurses attitude toward chemotherapy was at the midpoint, the mean value of attitude was higher than knowledge. In addition majority of nurses had developed some negative attitude toward chemotherapy administration due to they were not trained and have limited knowledge about the importance and use of chemotherapy administration and how to control the side effects. Also **Hewe et.al; (2011) [36]** pointed out that learning process associated with application of the evidence based guidelines, the health care providers attitudes and beliefs, support and integration of recommendations at an organizational level, resources constrains are factors affecting evidence based guidelines in the field of cancer care.

**The current study showed that the majority of nurses had feeling of anxiety** range from moderate to high level. There was significant correlation between time spent in working, years experiences in administration of chemotherapy, time qualified and items of anxiety / worry and attitude toward chemotherapy. The current study findings in agreement with research studies findings mentioned that the medication errors event may severely affect nurses leave them not only feel guilty but also suffer from great loss of self-confidence which may affect the

nurses work with different way. Accordingly it is not fascinating that nurses expressed that "being devastating "post doing medication administration errors [37,38].

**The current study results contradicted with a study was done by Verity (2008 ) [39]** who revealed that minority of nurses had a feeling of guilt and distress when they saw patient with complications and didn't avoid them . **Gauski study (2016) [22]** reported that there is unmatch between nurses knowledge and their practices. Also the more the nurse had high level of knowledge and competency in practice the more they use safety measures in practice with no knowledge related anxiety.

**All oncology nurses work in chemotherapy administration needed knowledge** about psychological and emotional care of cancer patients and their relatives. Also majority of them needed knowledge about administration of cytotoxic chemotherapy ,best use of equipment on administering chemotherapy ,side effects of cytotoxic chemotherapy, and extravasations' as a side effect of cytotoxic chemotherapy respectively while effect of administering chemotherapy on patients rooms environment was only needed knowledge by some of oncology nurses.

**Regarding ranking of knowledge needed by oncology nurses** , psychological and emotional care of cancer patients and their relatives was ranked as the first priority of needed knowledge by oncology nurses followed by administration of cytotoxic chemotherapy and the third priority of needed knowledge about best use of equipment on administering chemotherapy followed by side effects of cytotoxic chemotherapy, extravasations' as a side effect of cytotoxic chemotherapy and the last priority of needed knowledge was effect of administering chemotherapy on patients rooms at hospital.

**Concerning relation of attitude toward safe administration of chemotherapy and knowledge level needed and anxiety level among** the oncology nurses in the current study, the studied oncology nurses perceived that they were in need to high level of Knowledge about cytotoxic chemotherapy administered for cancer patients. Most of low level of total knowledge needed of the studied oncology nurses developed negative attitude while majority of nurses who had moderate level of total needed knowledge had positive attitude with significant relation between levels of total attitude score towards chemotherapy and levels of total knowledge needed. Also It was found that all of moderate needed knowledge of the studied nurses had moderate anxiety and most of studied nurses with low needed knowledge had moderate level of total anxiety while more than quarter of nurses with need of high level of knowledge had low level of anxiety. The attitude to cancer among health care professionals may have impact on their behaviors' and consequently patient care. If the attitude towards cancer and treatment are extremely negative, it may affect the patient outcomes. Also nurses had negative experiences would try to avoid cancer patient [15,37].

**This is in consistent with study findings was done by Krishnasamy et al., [18]** which revealed that perceived knowledge, attitudes and management with respect to

chemotherapy induced nausea and vomiting , personal knowledge about chemotherapy risk assessment to be adequate or advanced by the majority of nurses , but risk assessment knowledge as well as knowledge of chemotherapy-induced nausea and vomiting as was rated as only fair to poor in less than half percent & in a significant proportion of them.

**Moreover** in the current study statistical significant relation existed between total oncology nurses attitude & total scores of needed knowledge about safe administration of chemotherapy while insignificant correlation between nurses age and experience per years, anxiety and knowledge needed about safe administration of cytotoxic chemotherapy and attitude was found respectively. This means that nurses attitude affect their behaviors to administer chemotherapy safely since nurses working in oncology had positive attitude toward safe administration of chemotherapy needed high level of knowledge and had moderate level of anxiety respectively and the more oncology nurses had positive attitude and reported they that they are in need to increased knowledge to be at adequate level the more they feel high anxiety level to administer chemotherapy safely **Jassica (2006) [10], Mc Allister(2010) [37]** .

**Regarding Facilitators of safe cytotoxic chemotherapy administration as perceived by oncology nurses** in the current study, it was environmental, time factor, and hospital care delivery system . In relation to environment factors ,it includes, wide place with sufficient illumination and quite, sufficient number of rooms ,sufficient and suitable number of beds , available utensils, tools and devices, increased number of efficient nurses and available needed treatment drugs and fund for it. This is in line with **El Nagar (2016) [40]** study results who revealed that one of limitation to provide care for lung cancer patient was inadequate space in the room of patients. The current study findings confirmed by **Mohammad (2015) [41]** study findings which indicated that number of nurses working was inadequate as well as equipment. To meet safely patient needs, there is no single nursing staff to patient ratio across the whole range of wards. Also on focus patient care, emphasizing of all patients needs to be fulfilled by specialist oncology nurses, regardless the ward to which patients allocated, the time of the day or the day of the week is the major objective .**Nice Guidance (2014) [42]**.

**Concerning Time factor**, in the current study some oncology nurses from their experience in the work prefer morning time and other nurses prefer any time is suitable .Also the hospital care delivery system to be efficient and facilitators oncology nurses in the current study viewed that established laws for treatment priority, suitable system and the hospital routine easy and not disabling are considered of main value to facilitate safe chemotherapy administration. As confirmed by **research studies findings [15,38]** who mentioned that unrealistic workloads , inadequate or poor training may be caused by inadequate perception of hazards or inappropriate procedures as well as lead to high workload. Also inappropriate work schedules, time pressure which may affect nurses cognitive process ,lack of self-confidence and lead to unsafe medication administration practices & errors.

Moreover the current study results in line with institute of Medicare recommendations which highlight safety medication administration have a great concern so recommended that to monitor medication: provide safety literature, develop, implement a structured errors avoidance plan ,designated a practice wide medication safety officer with wide spread authority and responsibility to improve care, create safe work environment by looking at lighting and noise level minimize distraction and improving drug storage areas by separating looks a like and sound alike medication, promote accurate medication prescription, processing ,dispensing, administration and involve patient in education and conciliation program , continuously evaluate technology and automation for reduction of medication errors. To promote safe administration of chemotherapy American Society of Clinical Oncology (ASCO) and oncology nursing society developed a set of standards involving, preparation, and administration in 2009, using an integrated process encompass multistakholder contribution and opinions of public Neuss MN et al; (2013) [43]. Finally it is important to enable safe provision of chemotherapy administration because it can help in identification and stratification of anticipated risks and enable the key factors of patient safety to be considered in a structured and consistent way Al Nasser(2014 ) [44].

## CONCLUSION AND RECOMMENDATION

### RECOMMENDATIONS

1. Determination of obstacles" and empowerment of facilitators facing safe chemotherapy administration is crucial .
2. Increasing oncology nurses awareness toward safety especially safe chemotherapy administration based on assessment of level of knowledge needed, attitude, and anxiety among nurses working in oncology department and administer chemotherapy through continuing nursing education which is fundamental to develop nurses knowledge and skills to safe chemotherapy administration for cancer patient , attendance of training programs, workshops & updating their knowledge and participation in conferences and researches.
3. Designing chemotherapy safe preparation and administration protocol for nurses &. provide them with safety guidelines.

### CONCLUSION

Safe chemotherapy administration is the corner stone in nursing care of cancer patients. Obstacles facing safe chemotherapy administration are multiple and interrelated. The item of care which is one of the obstacles" caused most anxiety facing nurses for safe administration involved side effects of medications , extravasations , intervention to anaphylactic reactions and lack of knowledge. The most important obstacles related to nurses were knowledge level ,attitude, anxiety. Moderate anxiety level and near half of oncology nurses developed negative attitude toward safe chemotherapy administration. Significant relation existed between nurses attitude and level of knowledge needed about safe chemotherapy administration. Also significant relation existed between level of knowledge needed about

safe chemotherapy administration and anxiety level. Insignificant relation existed among age , years of experiences, anxiety level and attitude of nurses. Most of nurses working in oncology department expressed they are in need for high level of knowledge about safe chemotherapy preparation and administration. Changing the attitude of oncology nurses is needed through specialized scientific program about safe chemotherapy preparation and administration to develop their skills and updates their knowledge with focus on facilitators & overcoming obstacles' ' for safe administration .

### RECOMMENDATION FOR FUTURE RESEARCHES

Designing and implementing safe chemotherapy administration education program for nurses and evaluating its effect on patient experiences & clinical outcomes with respect to ameliorate and change nurses attitude toward cancer & safe chemotherapy administration.

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