

Nurses' Performance Regarding Chemotherapy Administration in the Clinic

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Abstract

Background :Chemotherapy is one of the major categories of the medical discipline specifically devoted to pharmacotherapy for cancer, which is called medical oncology. Chemotherapy is a category of cancer treatment that uses one or more anti-cancer drugs (Chemotherapeutic agents) as part of a standardized chemotherapy regimen. The goal of chemotherapy is to stop or slow the growth of cancer cells. The handling and administration of cytotoxic drugs are hazardous potentially to the health care professionals involved in their preparation and administration, and to the patients receiving them .**Aim of the study:** Assess nurses' performance regarding chemotherapy administration in the clinic through: Assess the nurses 'level of knowledge regarding chemotherapy administration in the clinic, assess the nurses 'level of practice regarding chemotherapy administration in the clinic and assess the nurses' level of attitude regarding chemotherapy administration in the clinic. **Research design:** A descriptive exploratory research design was utilized. **Setting:** The study was carried out in chemotherapy clinic at El-Fayoum University Hospital. **Study subjects:** A Purposive sample of (30) nurses who works in chemotherapy clinic included in the study. **Data collection tools:** Data were obtained through demographic data tool, nurses' knowledge questionnaire, nurses' observational checklist and nurses' attitude questionnaire. **Results:** More than two-thirds (66.7%) of the studied nurses had unsatisfactory level of knowledge and majority (83.3%) of studied nurses had unsatisfactory level of practice regarding chemotherapy administration. Approximately three quarters (73.3%) of the studied nurses had negative attitude regarding chemotherapy administration. There were statistically significant relations between the nurses' level of knowledge, practice and attitude regarding chemotherapy administration and their demographic characteristics as age .**Recommendations:** Designing in-service training and educational program to improve nurses' knowledge, practice and attitude regarding chemotherapy administration.

Key words: Nurses' Performance, Chemotherapy, Administration.

Introduction

Chemotherapy (chemo) usually refers to the use of medicines or drugs to treat cancer (American Cancer Society, 2016). Treatment that uses drugs to stop the growth of cancer cells, either by killing the cells or by stopping them from dividing. Chemotherapy may be given by mouth, injection, or infusion, or on the skin,

depending on the type and stage of the cancer being treated. It may be given alone or with other treatments, such as surgery, radiation therapy, or biologic therapy (National Cancer Institute, 2017).

Chemotherapy (sometimes just called 'chemo') is the use of drugs to kill or slow the growth of cancer cells. The drugs are called cytotoxics, which means toxic to cells (cyto). Some of these drugs are obtained from natural sources such as plants, while others are completely created in a laboratory. Chemotherapy drugs enter the bloodstream and travel throughout the body to reach cancer cells in the organs and tissues. Sometimes chemotherapy is delivered directly at the tumor site rather than via the bloodstream (**Bruce, 2016**).

The goals of chemotherapy depending on the type of cancer, its stage (how far it has spread), and where the patient is in the treatment process, chemotherapy can be used to: Cure the cancer, keep the cancer from spreading, slow the cancer's growth, kill cancer cells that may have spread to other parts of the body and relieve symptoms caused by cancer (**American Cancer Society, 2014**).

Anticancer treatments are systemic treatments that may produce many and varied side effects, both long and short term, throughout the body. These effects will vary depending on the doses and combinations of the drugs prescribed. Some common side effects are: nausea and vomiting, diarrhea, stomatitis, anorexia, bone marrow depression, risk of infertility, alopecia, fatigue, renal toxicity, cardiac toxicity, extra vasation and central nervous system toxicity. It is essential that relevant health care professionals have a good knowledge of the possible side effects of the chemotherapy, which is being delivered so that they can ensure the patient is fully informed (**American Society of Clinical Oncology, 2017**).

There is sufficient evidence to indicate that staff who prepare and administer cytotoxic drugs and deal with contaminated body fluids are potentially at risk and measures to minimise exposure should be taken. Expert review suggests that efforts should focus on improving drug handling and staff education, and on compliance with guidelines for good practice

rather than pursuing measurement of occupational exposure. The risks fall into two categories: The proven local effects caused by direct contact with the skin, eyes and mucous membranes, e.g. dermatitis, inflammation of the mucous membranes, blistering, allergic reactions and the systemic effects of inhaling, ingesting or injecting cytotoxic drugs during administration (**Landry, 2017**).

Reducing the risk includes: Using appropriate gloves; change gloves and changing them as manufacturers recommend, wash hands thoroughly after all handling activities, change out of protective clothing used when not handling cytotoxics, do not eat, drink or apply make-up in environments where cytotoxic drugs given, stored or disposed of and ensure effective cleaning of all equipment and environment (**Mills, 2017**).

All staff involved in the handling of cytotoxic drugs should attend a training session on the handling of cytotoxic drugs and on the management of cytotoxic spillages as part of their orientation and yearly update. Protective Personal Equipment (PPE) is necessary when handling cytotoxic drugs and cytotoxic waste. PPE worn during administration and disposal of cytotoxic medication and when dealing with a cytotoxic spillage should include: gloves, gown/apron, eye protection and masks (**Aesty, Coakely, Cheng & Cividino, 2015**).

Key roles of the oncology nurse in cancer chemotherapy management are to assess the patient for adverse events, and to provide support by addressing the patient's concerns. In a collaborative practice, the oncology nurse is also directly responsible for the education of the patient in symptom management, especially during chemotherapy. It is imperative for the oncology nurse to be knowledgeable regarding the current regimens, their associated toxicity profiles, and the tools used in symptom management, in order to maximally enhance the patient's safety while receiving chemotherapy, and improve the patient's overall quality of life (**Hollywood & Semple, 2017**).

There must be a current and appropriate plan of care for patients receiving cytotoxic drugs. The plan must incorporate on-going evaluation and reassessment of care and evidence that the relevant interventions and observations have been communicated to appropriate members of the multidisciplinary team (Mills, 2017).

Aim of the Study:

Assess the nurses' performance regarding chemotherapy administration in the clinic through:

1-Assess the nurses' level of knowledge regarding chemotherapy administration in the clinic.

2- Assess the nurses' level of practice regarding chemotherapy administration in the clinic.

3- Assess the nurses' level of attitude regarding chemotherapy administration in the clinic.

Research Questions:

1-What are the nurses' level of knowledge regarding chemotherapy administration in the clinic ?

2- What are the nurses' level of practice regarding chemotherapy administration in the clinic ?

3- What are the nurses' level of attitude regarding chemotherapy administration in the clinic ?

Subjects and Methods:

Research design:

A descriptive exploratory design was utilized for the conduction of this study.

I-The technical design:

Include setting, subject and tools for data collection.

Setting:

The present study was conducted at the outpatient clinic of chemotherapy at El-Fayoum university hospital

Subjects:

A Purposive sample of (30) nurses who works at previously mentioned setting, work more than 6 months, divided as follows:(5) bachelor of nursing, (10) technical health institute and (15) diploma nursing after obtaining their consent to participate in the study.

Tools for data Collection:

Three tools for data collection were used in the current study as the following:

1-Self administrated questionnaire:

This questionnaire was developed by the researcher in an Arabic language based on review of relevant literatures, it was used to assess nurses' level of knowledge regarding chemotherapy administration in the clinic and it included two parts:

A- Demographic characteristics of nurses:

The studied subjects' characteristics included age, gender, marital status, level of education, years of experience and previous training.

B- Nurses' knowledge assessment questionnaire regarding chemotherapy administration:

It concerned with assessment of nurses' level of knowledge. It was developed by the researcher based on reviewing of scientific

related literatures (Verstrate, 2015; McCullagh, 2014; WHO, 2013&Polovich, 2010). The tool consists of 40 questions, 35 questions in the form of multiple choice questions (MCQs) and 5 questions in the form of matching. The 40 questions are divided into 5 categories that assess knowledge of nurses regarding: The nature of the work of chemotherapy (4 questions), side effects and complications of chemotherapy (8 questions), nursing care for patients receiving chemotherapy (20 questions), safe handling of chemotherapy (3 questions) and cytotoxic drug toxicity (5 questions).

Scoring system:

Classified as follows; correct answer was given 1 grade and incorrect answer was given zero. A total score for the questionnaire was 40 grades. Score less than 75% (<30 grades) was considered unsatisfactory and the score equal or more than 75% (≥ 30 grades) was considered satisfactory.

2-Nurses' practice observational checklist regarding chemotherapy administration:

It was developed by the researcher based on comprehensive reviewing and recent literatures regarding chemotherapy administration (Kline, 2014; Williams & Wilkins, 2014; Leung, Bland, Baldassarre, Green & Kaizer, 2012) to assess the nurses' practice in the outpatient clinic of chemotherapy regarding chemotherapy administration. It consisted of 2 parts:

Part I: Safe handling of chemotherapy checklist, it comprised 18 steps covering the following: Safe environment (4 steps), safe nursing practices during administration of cytotoxic drugs (10 steps), safe handling during disposal of cytotoxic agents and equipment used in its administration (4 steps).

Part II: Administration of cancer chemotherapy observation checklist, it comprised 36 steps covering the following: Patient assessment (4 steps), IV administration of cancer chemotherapy/cytotoxic drugs via

infusion in peripheral vein (17 steps), IV administration of cancer chemotherapy/cytotoxic drugs via infusion in a central venous access device (CVAD) (15 steps).

Scoring system:

The response to each item in the procedure was categorized into (done correctly & not done) and one grade was given for each correct step and zero for each incorrect step or not done. A total score for the checklist was 54 grades. Score less than 75% (<40.5 grades) was considered unsatisfactory and the score equal or more than 75% (≥ 40.5 grades) considered satisfactory.

3-Nurses' attitude assessment questionnaire:

It was developed by the researcher based on comprehensive reviewing and recent literatures (Wiseman, Verity, Ream, Alderman & Richardson, 2010). The questionnaire consisted of 20 statements (8 positive and 12 negative) to assess nurses' attitude regarding chemotherapy administration in the out patient clinic. Nurses were asked to respond to statements on a 3-point Like at Scale (agree, to some extent and disagree).

Scoring system:

Classified as follows the highest possible score of nurses' attitude was 40. The attitude scale included both positive and negative statements. Positive attitude statements were scored 2 = agree, 1 = uncertain, zero = disagree, conversely negative attitude statements were scored zero = agree, 1 = uncertain, 2 = disagree. It was considered a score less than 75% (<30 grades) was negative attitude and a score equal or more than 75% (≥ 30 grades) was positive attitude.

II- Operational Design:

The operational design included preparatory phase, content validity, tool reliability, ethical consideration, pilot study and field work.

The preparatory Phase:

It included reviewing of related literatures and theoretical knowledge of various aspects of the study using books, articles, internet's periodicals and magazines to develop tools for data collection.

Tool validity and reliability

Tool validity:

Validity of the developed tools was tested using face and content validity. Validity was tested through a panel of seven experts from medical surgical nursing department: (2) professors, (3) assistant professors and (2) lecturers from faculty of nursing, Ain shams university to ensure tools' comprehensiveness, accuracy, clarity, understanding, applicability and relevance.

Tool reliability:

Reliability of the developed tool was tested to determine the extent to which the questionnaire items are related to each other. The *Cronbach's alpha* test which is a test used to measure internal consistency was used in the analysis (value throughout the assessment are 0.71 for the knowledge questions, 0.80 for practice observational check list and 0.81 for attitude scale. Statistical equation of *Cronbach's alpha* reliability coefficient normally ranges between 0 and 1, higher value (more than 0.7) denote acceptable reliability

Ethical consideration

Approval of the study protocol was obtained from ethical committee in the faculty of nursing at Ain Shams University before starting the study. The researcher clarified the objective and aim of the study to the nurses included in the study. The researcher assured maintaining anonymity and confidentiality of the subjects' data. Nurses were informed that they allowed choosing to participate or not in the study and

that they have the right to withdraw from the study at any time without giving any reasons.

Pilot study

A pilot study was carried out on 10% of nurses (three nurses) from the study subjects to test the clarity, applicability, feasibility and relevance of the tools used, as well as to determine the needed time for the fill out of the study tools. The nurses who were included in the pilot study were included in the study subjects because no modification was done after conducting pilot study.

Field work

The purpose of the study was simply explained to the nurses who agree to participate in the study prior to data collection. The actual work of this study started and completed within three months from the beginning of march (2017) to the end of May (2017). Data were collected by the researcher through two days per week (Saturday and Sunday), at morning and afternoon shifts in the previous mentioned setting. The observation checklist was completed by the researcher and it took 30 minutes for every nurse when providing the care for patients. The time needed for completing the tools was about 45 minute by every nurse (30 minutes for knowledge & 15 minutes for attitude). The nurses assured that the information collected would be treated confidentially and that it would be used only for the purpose of the study.

III-Administrative Design:

To carry out this study, the necessary approval was obtained from the hospital' director. A letter was issued to them from the faculty of nursing, Ain Shams University explaining the purpose of the study to obtain the permission for conducting this study.

IV- Statistical Design:

The collected data were organized, categorized, tabulated and statistically analyzed using the statistical package for social science (SPSS) version (20) to assess nurses' level of knowledge, practice and attitude regarding chemotherapy administration in the clinic.

Data were presented in tables and graphs. The statistical analysis included; percentage (%), the

arithmetic mean (\bar{X}), standard deviation (SD), chi-square (χ^2) and P-value.

Results:

Table (1):Demographic characteristics of nurses under study (N=30).

Nurses' characteristics		No.	%
Age (years)	≤30	16	53.3
	>30	14	46.7
	Mean±SD	29.8±3.92	
Gender	Male	4	13.3
	Female	26	86.7
Marital status	Single	3	10.0
	Married	25	83.3
	Divorced	2	6.7
Education	Diploma nursing	15	50.0
	Technical health institute	10	33.3
	Bachelor of nursing	5	16.7
Years of experience in nursing	3years	11	36.7
	≥5years	19	63.3
Frequency of giving chemotherapy	2 days / Week	30	100.0
Training	Yes	1	3.3
	No	29	96.7
Information about chemotherapy	self-learning	28	93.3
	Internet	2	6.7

Table (1): Illustrated that 53.3% of the studied nurses their age was ≤30years with a mean 29.8±3.92, 86.7% of them were females, 83.3 % of them were married, 50.0% of them had diploma nursing degree, 63.3% of them had more than 5 years of experience, 96.7% of them didn't attend any training course about chemotherapy administration and 93.3% of them got information about chemotherapy by self learning.

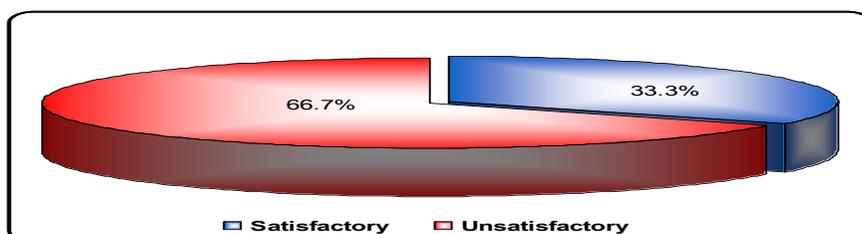
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Table(2):Percentage distribution of the studied nurses regarding to their level of knowledge toward chemotherapy administration (N=30).

Items of knowledge	Satisfactory		Unsatisfactory	
	N	%	N	%
The nature of the work of chemotherapy	21	70	9	30
Side effects and complications of chemotherapy	16	53.3	14	46.7
Nursing care for patients receiving chemotherapy	15	50.0	15	50.0
Safe handling of chemotherapy	28	93.3	2	6.7
Cytotoxic drug toxicity	5	16.7	25	83.3
Total	10	33.3	20	66.7

Table (2): illustrated that, 70% of the studied nurses had satisfactory knowledge about the nature of the work of chemotherapy and 93.3% of them had satisfactory knowledge about safe handling of chemotherapy, while 83.3% of them had unsatisfactory knowledge about cytotoxic drug toxicity.

Figure (1): Percentage distribution of the studied nurses regarding to their total level of knowledge toward chemotherapy administration (N=30).



Figure(1): In relation to total knowledge, 33.3% of nurses under study had satisfactory level of knowledge about chemotherapy administration while 66.7% of nurses had unsatisfactory level of knowledge about chemotherapy administration.

Figure(2):Percentage distribution of the studied nurses regarding to their total practice toward chemotherapy administration (N=30).

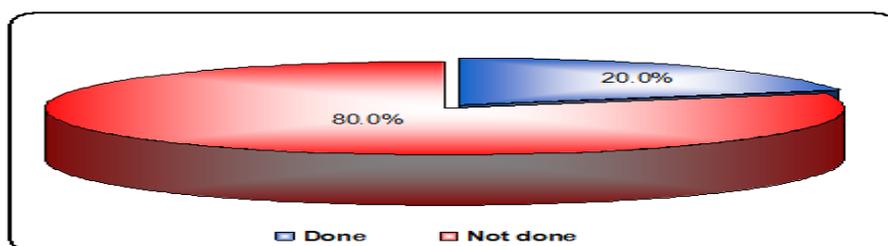


Figure (2): Illustrated that, 20% of the studied nurses had satisfactory level of total practice regarding chemotherapy administration, while 80%ofthe studied nurses had unsatisfactory level of total practice regarding chemotherapy administration.

Figure (3): Percentage distribution of the nurses' attitude regarding chemotherapy administration among nurses under study (N=30).

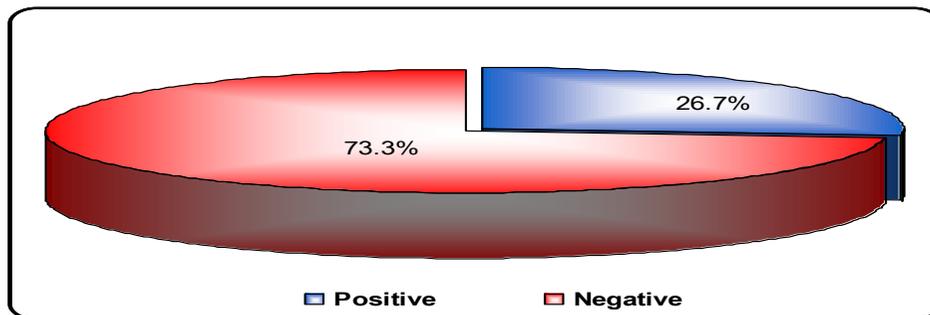


Figure (3): Illustrated that, 26.7% of the nurses under study had positive attitude regarding chemotherapy administration, while 73.3% of studied nurses had negative attitude regarding chemotherapy administration.

Table (3): Correlation between nurses' knowledge, practice and attitude regarding chemotherapy administration.

Variables	Total Knowledge		Total Practice	
	R	p-value	R	p-value
Total Practice	0.534	<0.001**		
Total attitude	0.265	0.012*	0.312	<0.001**

**Highly statistical significant at $p \leq 0.001$

Table (3): Illustrated that there were statistically significant relations between the nurses' level of knowledge, practice and attitude ($p \leq 0.001$).

Discussion:

Chemotherapy is presently the main systemic treatment available to treat cancer. One in three people diagnosed with cancer approximately 60% will receive chemotherapy as part of their treatment. Over the last two decades chemotherapy administration has increasingly become the role of the nurse. Nurses have four main roles in the chemotherapy administration process: educating patients and their families about this form of therapy, administering the chemotherapy agents safely and managing any side effects patients may have. In addition, nurses need to support patients

emotionally through the process (Wiseman, 2015).

Regarding the study nurse's demographic characteristics, the results of the present study revealed that about more than half of the studied nurses had age less than thirty years with a mean 29.8 ± 3.92 . This finding is consistent with Chaudhary & Karn, (2012) who reported that the mean age of the studied nurses was 28.9 ± 6.32 years in the study that titled "chemotherapy-knowledge and handling practice of nurses working in a medical university of Nepal".

Regarding gender, the results of the present study showed that the majority of the studied nurses were females. This finding is

consistent with **Keat, Sooid, Yun, & Sriraman, (2013)** who stated that the majority (93%) of the studied nurses were females in the study that titled "improving safety-related knowledge, attitude and practices of nurses handling cytotoxic anticancer drug in a general hospital, Malaysia".

Concerning educational level, the results of the present study indicated that, half of the studied nurses had diploma nursing degree. This finding is contradicted with **Waheida, Abd-ELghaffar, & Atia, (2015)** who reported that more than three quarters of nurses had diploma degree in the study that titled "evaluation of handling practices of oncology nurses during chemotherapy preparation and administration in Menoufia oncology hospital".

Regarding years of experience, the current study showed that approximately two thirds of the studied nurses had more than five years of experience. This finding in the same line with **Abd Al-Magid, Mohammed, Abd El latef & Mohammed, (2012)** who found that more than half of nurses had more than five years of experience in the study that titled "nursing care standards for cancer patients undergoing chemotherapy".

Regarding training courses, the current study showed that most of the studied nurses didn't attend any training courses about chemotherapy. This finding is contradicted with **Chaudhary & Karn, (2012)** who reported that no one of the studied nurses attend any training courses about chemotherapy in the study that titled "chemotherapy-knowledge and handling practice of nurses working in a medical university of Nepal".

Regarding total nurses' level of knowledge toward chemotherapy administration, the results of the current study stated that about more than two-thirds of the studied nurses had unsatisfactory level of knowledge regarding chemotherapy

administration. This result is congruent with **Vioral, (2014)** who found that more than half of the studied nurses had unsatisfactory knowledge regarding chemotherapy administration in the study that titled "examining oncology nurses' knowledge of chemotherapy errors". The inadequacy of nurses' knowledge might be due to lack of continuous educational programs and training courses in fayoum university hospital.

In relation to knowledge about the nature of the work of chemotherapy, the current study showed that more than two-thirds of the studied nurses had satisfactory level of knowledge regarding the nature of the work of chemotherapy. This result is contradicted with **Marcus, (2014)** who found that more than two-thirds of the studied nurses had unsatisfactory knowledge regarding the nature of the work of chemotherapy in the study that titled "Medication errors among adults with cancer in the outpatient setting". This result may be due to awareness of the studied nurses and experience about chemotherapy administration from self-learning as they stated.

In relation to side effects and complications of chemotherapy, the current study showed that more than half of the studied nurses had satisfactory level of knowledge regarding side effects and complications of chemotherapy. This result is congruent with **Vioral, (2014)** who found that more than half of the studied nurses had satisfactory knowledge regarding side effects and complications of chemotherapy in the study that titled "examining oncology nurses' knowledge of chemotherapy errors". This result may be due to increased awareness of nurses about chemotherapy from self-learning through internet or other resources in order to avoid side effects of chemotherapy.

Regarding nursing care for patients receiving chemotherapy, the present study showed that half of the studied nurses had

unsatisfactory level of knowledge regarding nursing care for patients receiving chemotherapy. This result is contradicted with **Shokier, Shaban, Gadiry&SeifEldin, (2012)** who found that one quarter of the studied nurses had unsatisfactory level of knowledge regarding nursing care for patients receiving chemotherapy in the study that titled "quality ambulatory oncology nursing practice for chemotherapeutic patients". This result may be due to lack of studied nurses' awareness, continuous educational programs and training courses about chemotherapy administration.

In relation to knowledge about safe handling of chemotherapy, the present study showed that most of the studied nurses had satisfactory level of knowledge regarding safe handling of chemotherapy. This result is contradicted with **Keat et al., (2013)** who found that one quarter of the studied nurses had satisfactory level of knowledge regarding safe handling of chemotherapy in the study that titled "improving safety-related knowledge, attitude and practices of nurses handling cytotoxic anticancer drug in a general hospital, Malaysia". This result may be due to exchange of knowledge and experience between nurses regarding safe handling of chemotherapy in order to avoid it's hazards.

As regards the total nurses' practice, the present study showed that majority of the studied nurses had unsatisfactory level of practice regarding chemotherapy administration. This is in line with **Abd Al-Magid et al., (2012)** who found that majority of nurses' practice regarding chemotherapy administration was unsatisfactory in the study that titled "nursing care standards for cancer patients undergoing chemotherapy". This could be attributed to inadequate in service training program, lack of knowledge about chemotherapy administration, as well as lack of close supervision.

The current study showed that approximately three quarters of studied

nurses had total negative attitude score regarding chemotherapy administration and more than one quarter of them had total positive attitude score.

Regarding correlations between total nurses' knowledge, practice and attitude, the current study showed that there was statistically significant correlations between nurses' knowledge, practice and attitude regarding chemotherapy administration. This finding is consistent with **Verstrate, (2015)** who reported that there was highly statistically significant correlations between knowledge, attitudes and practices of the study subjects in the study that titled "exploration of chemotherapy safe-handling practices and identification of knowledge deficits among oncology nurses in the ambulatory care setting".

Conclusion:

In the light of the present study findings, it can be concluded that:

About more than two-thirds of studied nurses had unsatisfactory level of knowledge regarding chemotherapy administration and majority of them had unsatisfactory level of practice regarding chemotherapy administration. Also, approximately three quarters of them had negative attitude regarding chemotherapy administration. In addition, there was statistically significant relation between total knowledge, total practice, total attitude and their socio-demographic characteristics as regards age and there was statistically significance relation between nurses' practice and attitude and years of experience.

Recommendations:

Based on the findings of the present study, the following suggestions are recommended:

For nurses:

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- Nurses should be encouraged to attend scientific meetings and conferences to gain up dated knowledge about chemotherapy administration for proper nursing services.
- Increase nurses awareness about policies and guidelines related to chemotherapy administration.
- Implementing an educational training program for nurses in chemotherapy clinic about chemotherapy administration guidelines.
- Orientation program for all newly employed nurses.
- Periodically and continuously, evaluation of nurses' performance should be done to improve quality of their performance.

For further researches:

- Replication of the present study on a large sample representing different hospital settings in Egypt to figure out the main aspects of this problem and also in order to generalize the results.

References:

- Abd Al-Magid, A., Mohammed, S., Mohammed, A., Abd El Latef, Z., (2012).** Nursing Care Standards for Cancer Patients Undergoing Chemotherapy, J Am Sci. Journal of American, Vol8 , No.3, PP17-20.
- Aesty, A., Coakely, N., Cheng, R., & Cividino, M., (2015).** Safe Handling of Cytotoxics: Guideline Recommendations, Current Oncology Journal, Vol 22, P28.
- American Cancer Society, (2016).** Chemotherapy. Available at www.Chemotherapy.org .Accessed on 3/5/2017, 3:00pm.
- American Cancer Society, (2014).** A Guide to Chemotherapy, Available at www.cancer.com. Accessed on 3/5/2017, 3:00pm.
- American Society of Clinical Oncology, (2017).** Chemotherapy Side Effects, Available at <http://www.cancer.net>, Accessed on 3/5/2017, 5:00pm.
- Bruce, J., (2016).** Understanding Chemotherapy , A guide for people with cancer, their families and friends, Cancer Council, Australia, 3rded, P8, Available at <https://www.cancer.org.au>.
- Chaudhary, R., & Karn, K., (2012).** Chemotherapy-Knowledge and Handling Practice of Nurses Working in a Medical University of Nepal, Journal of Cancer Therapy, Vol 3, pp110-114.
- Hollywood, E., & Semple, D., (2017).** Nursing Issues in Colorectal Cancer Chemotherapy, Available at <https://www.researchgate.net>.
- Keat, H., Sooid, N., Yun, Y., & Sriraman, M., (2013).** Improving Safety-Related Knowledge, Attitude and Practices of Nurses Handling Cytotoxic Anticancer Drug in a General Hospital, Malaysia, Asian Pacific Journal of Cancer Prevention, Vol 14, No.1, pp44-48.
- Kline, N.,(2014).** Essentials of Pediatric Hematology/Oncology Nursing: A Core Curriculum, 4thed, APHON, USA, P10
- Landry, A., (2017).** Safe Handling of Chemotherapy, Available at <http://www.cancernetwork.com>. Accessed on 4/7/2017, 2:00pm.

- Leung, M., Bland, M., Baldassarre, F., Green, E., & Kaizer, L., (2012)** . Safe Administration of Systemic Cancer Therapy Part 1: Safety During Chemotherapy Ordering, Transcribing, Dispensing, and Patient Identification, Available at <https://www.cancercareontario.ca>
- Marcus, M., (2014)**. NIOSH Study Documents: Medication Errors Among Adults with Cancer in The outpatient Setting Oncology Times, Vol36, PP12-13.
- McCullagh, L., (2014)** : Cancer & Oncology Nursing Available at <http://nurselabs.com>, Accessed on 5/5/2017, 3:00pm.
- Mills, B., (2017)**. Safe Handling of Chemotherapy, Available at <http://www.icid.salisbury.nhs.uk>, Accessed on 5/7/2017, 6:00pm
- National Cancer Institute, (2017)**. Chemotherapy. Available at <https://www.cancer.gov>.
- Polovich, M., (2014)**. Nurses' Use of Hazardous Drugs Safe Handling Precautions, Georgia State University, Master Thesis, PP418-420.
- Polovich, B., (2010)** : Cancer Registration & Surveillance Modules Available at <http://training.seer.cancer.gov>
- Shokier, M., Shaban, F., Gadiry, S., SeifEldin, I., (2012)**. Quality Ambulatory Oncology Nursing Practice for Chemotherapeutic patients, Journal of American Science Vol8, Issue12, pp15-18, Available at <http://www.jofamericanscience.org>
- Verstrate, CH., (2015)**. Exploration of Chemotherapy Safe-Handling Practices and Identification of Knowledge Deficits among Oncology Nurses in the Ambulatory Care Setting, Grand Valley State University, Available at bouwkach@mail.gvsu.edu
- Vioral, A., (2014)**. Examining Oncology Nurses' Knowledge of Chemotherapy Errors Using Two Self-Directed Learning Strategies, Indiana University of Pennsylvania, Master Thesis, pp220-222.
- Waheida, S., Abd-ELghaffar, S., & Atia, G., (2015)**. Evaluation of Handling Practices of Oncology Nurses during Chemotherapy Preparation and Administration in Menoufia Oncology Hospital, International Journal of Novel Research in Healthcare and Nursing , Vol. 2, Issue 3, pp107-119.
- WHO, (2013)** : Nursing Practice Test Exam about Cancer Available at www.nclexpinoy.com
- Williams, L. ,& Wilkins, S., (2014)** : Lippincott's Nursing Procedures, 5th ed, Judith A., Philadelphia, PP326-327
- Wiseman, T., Verity, R., Ream, E., Alderman, E. & Richardson, A., (2010)**. Exploring the Work of Nurses who Administer Chemotherapy Un Published Thesis, University of London, PP290-295
- Wiseman, E., (2015)**. Exploring the Work of Nurses who Administer Chemotherapy, Master Thesis, P10.