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Anti-Neoplastic Agent's Safety Training Module: Its Effect on Nurses' Knowledge and Practice in Sabha Oncology Center

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1.ABSTRACT

Background: The administration of chemotherapy is a high-risk practice which entails numerous risk factors with a high error index. The safe and standard handling of antineoplastic drugs can reduce the effects of occupational exposure and promote safe behaviors in nurses. Thus, the present study **aimed** to evaluate the effect of chemotherapy safety standard guidelines on oncology nurses' knowledge, and practice. **Methods**: A quasi-experimental design one-group pretest posttest was utilized. **Sample/Setting**: A convenient sample of all available nurses working in Sabha oncology centers Libya who met inclusion criteria was selected. **Study tools:** The data were collected by using a demographic data form and nurses 'knowledge assessment questionnaire regarding the standard guidelines for working with antineoplastic drugs, and a standard checklist for examining their skills in this regard. were analyzed by descriptive (mean and standard deviation) and inferential statistics (t-test) and Pearson's correlation coefficient) in SPSS 26. **Results:** the data revealed that, there were High statistically significant differences regarding nurses' knowledge and practice mean scores were found between the pre-test, and post-test (34.61±7.42,47.83±2.22 for knowledge, & 23.00±17.5029.00±26.22for practice) respectively, where P values of Wilcoxon test P = 0.000. **Conclusions:** A significant improvement in nurses' knowledge and practice was found after implementation of the teaching program which supported the study hypotheses.

Keywords: *Oncology, Nurses, safety training, Anti-Neoplastic Agents*

2.Introduction:

Exposure to anti-neoplastic drugs (ANPDs) among oncology nurses has been increasing due to the widespread use of these agents. The anti-neoplastic agents' exposure may lead to toxicological effects including carcinogenicity, teratogenicity, and mutagenicity in human. Several guidelines and protocols have been established in order to improve the safe handling of ANPDs and protect oncology nurses against unwanted exposure. Despite the presence of these guidelines, some studies have shown different levels of exposure to ANPDs among health care workers, particularly in developing countries. (Talib, &, Ahmed,2021).

Direct exposure of health care providers to ANPDs can occur during admixture, transport, preparation, and administration, as well as during waste handling. Nurses are among the main groups of professionals that are involved in these activities and have the potential for exposure to these drugs in patient care settings. (Simegn, Dagnew, & Dagne,2020).

The typical routes of exposure involve drug inhalation, ingestion, or absorption and accidental needle stick injury during the process of handling. Oncology nurses may inhale droplets, particulates, and vapors when these drugs create aerosols during drug preparation or while cleaning up spills. Dermal exposure may occur when the nurses touch contaminated surfaces during the preparation, administration, or disposal of hazardous ANPDs or patient wastes, and oral exposure may occur from hand-to-mouth contact or ingestion of contaminated food or drink. Other drug manipulations and work tasks also involve activities that may result in exposure through inhalation, skin contact, ingestion, or injection. (Fazel et al.,2022).

2.1Significance of the study:

Cancer incidence and deaths According to WHO in Libya 6871287 new cancer cases and 4750 cased of deaths (Ferlay et al., 2021).

The toxicities associated with ANPDs have been well documented since their initial clinical use. Healthcare workers are at constant risk of exposure to these potential toxicities. Improving health and safety should be an essential commitment for healthcare management and it is incumbent on all employees to adhere to recommended work practices. The use of PPE has

been shown to substantially reduce worker exposure to ANPDs. Comprehensive and ongoing education and training for all staff involved in this process is vital. Management must ensure that appropriate policies, procedures, protocols and guidelines are in place regarding health and safety and that they are implemented and evaluated regularly (Soheili et al., 2021).

2.2Aim of the Study

The aim of this study was to evaluate the effect of chemotherapy safety standard guidelines on oncology nurses' knowledge and practic.

2.3Study Hypotheses

H1: Oncology nurses who participated in the educational training will exhibit improvement in mean knowledge score post training.

H2: Oncology nurses who participated in the educational training will experienced higher practice mean score post training.

3.Method

3.1Study Design:aquazi-experimental research design (one-group pretest posttest) was utilized to achieve the aim of the study.

3.2Setting:

This study was conducted at Sabha Oncology Centers Libya.

3.3Study Sample.

A convenient sample of all available nurses working in Sabha oncology centers Libya was selected as a study sample. Those who provide direct patient care.

3.4Tools of data collection:

Three tools will be used to collect data pertinent to the study:

Tool I: Nurses' Demographic Data:

Include nurses' age, gender, marital status, educational qualification and years of experience in oncology field. Workplace related variables such as: previous training courses regarding safe handling chemotherapy, history of exposure during work.

Tool II: Nurses' knowledge about safe handling of chemotherapy

This tool was adapted from Zayed, Saied, El-Sallamy, and Shehata, (2019). It was used to assess nurses' knowledge in safe handling of anti-neoplastic agents using pre-posttest.

Scoring:

The correct answer was scored (1), the incorrect answer, and not known will be scored (0). Total knowledge score converted into percentage and categorizes into: ≥75 will considered a satisfactory level of knowledge (degrees or more), <75 will considered as an unsatisfactory level of knowledge.

Tool III: Nurses' Practice Observational Checklist

It was developed by the researcher after reviewing the related literature (Zayed, Saied, El-Sallamy, & Shehata,2019).

Scoring:

The correct performance of each step was given a score of (1), and (0) for the incorrect or not done step, and categorized (according to CDC & NIOSH standards 2015), getting 80% and more (23.2 or more) was considered accepted (satisfactory) while below 80% (less than 23.2) was considered not accepted (unsatisfactory).

3.5Validity:

Study tools were submitted to a panel of seven reviewers and experts in medical surgical nursing and Oncology and Nuclear Medicine Department. Each one of the experts on the panel was asked to examine the instrument for content coverage, clarity, wording, length, format, and overall appearance. Modifications of tools were done according to panel judgment.

3.6Reliability:

Reliability of the tools were tested using Cronbach's Alpha which showed satisfactory level of reliability (0.759, and 0.846) respectively.

3.7A Pilot study:

The Pilot study was conducted prior to data collection on 10% Oncology nurses to evaluate the clarity and applicability of these tools. Based on the findings of the pilot study, necessary modifications were done and the pilot study was excluded from the study sample.

3.8Data collection procedure

This study was conducted in three phases:

Phase 1: Preparatory and planning phase:

- An Ethical approval was obtained from the Research Scientific Ethical Committee of the Faculty of Nursing, Mansoura University.
- Permission was obtained from the responsible authority of the Oncology Center at Sabah oncology centers.
- Verbal explanation of the aim and the nature of the study was explained to all Oncology nurses to gain their cooperation in data collection.

- Preparing the educational material in the form of a PowerPoint presentation and educational videos and posters.

Phase 2: Implementation phase:

- It was beginning with assessment of oncology nursing staff regarding knowledge, practice in safe handling of anti-neoplastic agents using the tool I'II as pretest.
- The researcher was divide the studied nurses into five groups, and each group consisted of ten nurses.
- The educational training was implemented in form of 2 sessions, knowledge and practical session each session will last about 45 minutes, including periods of discussion according to the nurses' progress and feedback as following:
- The first session was cover overview of anti-neoplastic agents' definition, effects of exposure to anti-neoplastic agents', management of adverse health effects of anti-neoplastic agents', guidelines safe handling of anti-neoplastic agents.
- The second session was focus on practical training and demonstration to safe handling of chemotherapy drugs was done through a training video re demonstration.
- Different teaching tools and media was use group discussions, demonstration, re demonstration and presentations, video.

Phase III: Evaluation phase:

This phase aims to evaluate the effect of chemotherapy safety standard guidelines on oncology nurses' knowledge and practice. using posttest.

3.9Statistical Analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software version 22. The categorical variables were represented as frequency and percentage. Whereas continuous variables were presented as mean and standard deviation (SD). Wilcoxon signed rank test was utilized to test difference of non-parametric continuous variables between paired groups. McNemar test was used to test differences between paired group related dichotomous variables. Statistically significant was considered at p-value $\leq$ 0.05 &0.01.

3.10Ethical Considerations and Human Rights

Ethical approval was obtained from the Research Ethical Committee of Faculty of Nursing Mansoura University Prior to the study, informed consent was obtained from each nurse enrolled in the study after providing comprehensive information about the nature of the study, aim, benefits, risks, the researcher were emphasizing that participation is voluntary and confidential. Participants was informed that they have the right to refuse to participate in the study and withdrawn at any time and the refusal to participate in the study will not effect on their work. Anonymity, privacy, safety and confidentiality was assured throughout the whole study.

4.Results

Table (1) The mean age of the studied nurses was 30.72 with SD (5.46). More than half of the studied nurses (54.3%) aged 20-30 years old, 39.1% of them aged 31-40 years old and 6.5 % them aged more than 40 years old. The majority of the studied nurses (89.1%) were female and 10.9 % of them were male. More than half of the studied nurses (58.7%) were married and 41.3 % was single. Slightly less than two third of the studied nurses (69.6%) had bachelor degree of nursing science and 30.4% had high diploma degree. The mean year of the studied nurses' experiences was 3.79 with SD (2.41). Half of the studied nurses (50.0%) had 1-3 experience years, 37.0 % had 4-6 experience years and 13.0% had 7-10 experience years.

Table (2) The majority of the studied nurses (82.6%) did not attended training courses regarding safe handling chemotherapy and 17.4% of them had attended training. Slightly more than half of the studied nurses (52.2%) had exposed to hazards during work and 47.8 % of them did not exposed to hazards during their work. Slightly less than one quarter of the studied nurses (23.9%) had hand spills of chemotherapy drugs, 21.7% had skin contact, 6.5% had face and eye splash, and 2.2 % had ingested.

Table (3) and figure (1) show statistically significant differences related nurses' knowledge and its eight subscales regarding safe handling of chemotherapy drugs before and after chemotherapy safety educational training. There was statistically significant improvement in nurses' knowledge and its eight subscales regarding safe handling of chemotherapy drugs after chemotherapy safety educational training.

Table (4) and figure (2) show statistically significant differences related nurses' practice and its three subscales regarding safe handling of chemotherapy drugs before and after chemotherapy safety educational training. There was statistically significant improvement in nurses' practice and its three subscales regarding safe handling of chemotherapy drugs after chemotherapy safety educational training.

5.Discussion:

Anti-Neoplastic agents result in disruption of the growth of both normal and diseased cells, and lead to toxic side effects for both patients receiving these drugs and health care workers involved in different steps of handling them such as preparation, administration, transport, cleaning of spills and handling of wastes. Nurses are the health care workers most exposed to the toxic effects of these drugs so they are in need for specialized knowledge, skills and attitude to ensure their own safety as well as patients' safety (Zayed, Saied, El-Sallamy, & Shehata,2019).

Although guidelines for safe handling of anti-neoplastic agents were introduced more than 20 years ago, contamination of both the working environment as well as the health care workers is still reported in several recent studies particularly in developing countries. Lack of knowledge, economic and socio-cultural factors are major determinants of unsafe behavior related to handling of anti-neoplastic agents by health care workers (Nouri, Seyed Javadi, Iranijam & Aghamohammadi 2021).

Demographic and workplace characteristics of the studied nurses

Regarding the study nurse's demographic characteristics, the results of the present study revealed that more than half of the studied nurses aged 20-30 years old. This finding was consistent with a study done by Mishra, Bhawana and Kushwaha (2021) titled "chemotherapy safe handling through educating nurses" they stated that about more than half of their studied nurses had age less than thirty years. The same result documented by Aristizabal-Pachon and Castillo, (2019) in a study titled "Genotoxic evaluation of occupational exposure to antineoplastic drugs"

Nurses' knowledge about safe handling of chemotherapy.

The findings of the present study confirmed that there was significant improvement in knowledge mean score of chemotherapy administration post nursing intervention when compared to mean score pre intervention (47.83±2.22 &34.61±7.42) where $p < 0.0001$.

This come in accordance with findings of Mishra, Bhawana and Kushwaha (2021) who revealed that nurses' knowledge related to handling of chemotherapeutic agent was unsatisfactory preprogram, and they show obvious improvement in knowledge level after administration of structured teaching program regarding safe handling of chemotherapeutic drugs. Interestingly results reported in the study by Abu Sharour, Subih, Bani Salameh and Malak, (2021), that oncology nurses' level of knowledge related to chemotherapy exposure pre training was unsatisfactory which necessitate planning and implementation of educational programs to improve their knowledge.

Also study by Nouri, Seyed Javadi, Iranijam and Aghamohammadi, (2021). Confirmed that, the level of nurses' knowledge on the safe handling of antineoplastic drugs significantly increased following educational training program in all stages of drug preparation, drug administration, drug leakage, and waste disposal. Another study by Jiyoon and Jeong Yun (2019) and Polovich (2020) confirmed that nurses come in contact with anticancer drugs needs continuing education and promotion of the proper implementation of chemotherapy administration safety because most of them exhibit unsatisfactory level of knowledge regarding chemotherapy in its related safety measures.

Study by von Grünigen, Geissbühler and Bonnabry (2022) revealed that nurses' knowledge regarding chemotherapeutic drugs was unsatisfactory that improved post involvement in training program about safe handling of antineoplastic agent. Initial and continuous staff education about safe handling, with proper knowledge checks and supervision, is a core element of safety and the quality of care it should never be neglected. Spill, contamination of personnel, or extravasation, the lack of clear written procedures and the unavailability of emergency management kits in many facilities from lower-middle and low-income countries also revealed important weaknesses in procedures.

The results from this study confirmed our hypothesis that " Oncology nurses who participated in the educational training will exhibit improvement in mean knowledge score post training implementation".

Nurses' practices regarding safe handling of chemotherapy.

As regards the total nurses' practice, regarding safe handling of chemotherapy the present study showed that there was statistically significant improvement in total practice mean score after implementing chemotherapy safety training compared to pre- intervention (29.00±26.22 and 23.00±17.50) respectively.

Our results confirmed by Asefa, Aga., Dinegde and Demie, (2021), who reported an improvement on oncology nurses practice to a good and excellent level after application of training courses regarding handling of cytotoxic drugs. Additionally, Zayed, Saied, El-Sallamy, and Shehata, (2019) found a significant improvement in practice of oncology nurses following implementation of training protocol, and reported that a training intervention positively affects the nurses' practice regarding the safe use of anti-neoplastic drugs.

From the findings of the present study we can accept research hypothesis that state " Oncology nurses who participated in the educational training will experienced higher practice score post training implementation".

6.Conclusion.

Implementing Safe Handling chemotherapy training program Improves nurse knowledge practice regarding chemotherapy handling.

7.Recommendations

1. Oncology nurses' awareness of the importance of following the guidelines of safe handling of chemotherapy drugs should be disseminated on the national level.
2. Nursing students should be taught the competencies of safe handling of hazardous drugs.
3. Further studies are recommended to explore the correlates of the oncology nurses' knowledge, practice and other variables such as socio-demographics, previous work experiences…etc

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Table (1): Demographic characteristics of the studied nurses (N=46)

Characteristics	n	%
Age (years)		
▪ 20- 30	25	54.3
▪ 31 – 40	18	39.1
▪ >40	3	6.5
Mean±SD	30.72±5.46	
Gender		
▪ Male	5	10.9
▪ Female	41	89.1
Marital status		
▪ Single	19	41.3
▪ Married	27	58.7
Education		
▪ Bachelor degree	32	69.6
▪ High diploma	14	30.4
Experience (years)		
▪ 1-3	23	50.0
▪ 4-6	17	37.0
▪ 7-10	6	13.0
Mean±SD	3.79±2.41	

Table (2) Workplace characteristics of the studied nurses (N=46)

Previous training courses regarding safe handling chemotherapy	n	%
▪ Yes	8	17.4
▪ No	38	82.6
History of hazards exposure during work		
▪ Yes	24	52.2
▪ No	22	47.8
Type of exposure *		
▪ Face splash	3	6.5
▪ Eye splash	3	6.5
▪ Hand spills	11	23.9
▪ Skin contact	10	21.7
▪ Ingestion	1	2.2

Table (3): Mean differences of nurses' knowledge regarding safe handling of chemotherapy drugs before and after chemotherapy safety educational training (N=46)

Nurses' knowledge dimensions	Pre	Post	Z	p
	Mean±SD	Mean±SD		
▪ Nature of cancer and risk factor	4.34±1.23	5.63±0.53	4.92	0.000**
▪ Chemotherapy action	2.34±0.76	2.67±0.52	2.48	0.01**
▪ Side effect of chemotherapy for patient and nurse	4.65±1.33	5.78±0.78	5.11	0.000**
▪ Side effect of exposure to chemotherapy for nursing staff	2.17±1.58	4.82±0.67	5.61	0.000**
▪ Activities that cause chemotherapy risks	3.13±1.42	4.89±0.37	5.36	0.000**
▪ Medical wastes contaminated with chemotherapy drugs	4.23±1.77	5.95±0.20	5.02	0.000**
▪ Intervention for chemotherapy extravasation	5.93±1.83	7.91±0.35	5.19	0.000**
▪ Intervention for chemotherapy spillages	7.78±1.76	10.15±0.41	5.61	0.000**
▪ overall knowledge regarding safe handling of chemotherapy drugs	34.61±7.42	47.83±2.22	5.84	0.000**

Table (4): Mean differences of nurses' practice regarding safe handling of chemotherapy drugs before and after chemotherapy safety educational training (N=46)

Nurses' practice dimensions	Pre	Post	Z	p
	Mean±SD	Mean±SD		
▪ Nurses practices in chemotherapy preparation	10.00±7.04	13.00±11.43	5.93	0.000**
▪ Nurses practice during chemotherapy administration	8.00±5.08	10.00 ±8.86	5.94	0.000**
▪ Nurses practices after chemotherapy administration	6.00±5.36	6.00±5.91	3.84	0.000**
▪ Overall performance regarding safe handling of chemotherapy drugs	23.00±17.50	29.00±26.22	5.92	0.000**