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Original Research Article

Evaluating the knowledge, attitude, and practice of oncology nurses towards the safe handling of anti-neoplastic drugs

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ABSTRACT

Background: Safe handling of anti-neoplastic drugs (ADs) is critical for oncology nurses due to the potential health risks of occupational exposure. Occupational exposure to antineoplastic agents and safe handling of cytotoxic drugs (CDs) had gained a high concern among oncology nursing staff due to their potential health risks. This study evaluates the knowledge, attitude and practices (KAP) of oncology nurses towards the safe handling of these drugs at King Abdullah Medical City, Makkah, Saudi Arabia.
Methods: A cross-sectional survey was conducted among 88 oncology nurses across oncology, hematology, and chemotherapy units using a validated questionnaire.
Results: Results showed that nurses demonstrated good knowledge regarding cytotoxicity, correct use of personal protective equipment (PPE), and waste disposal methods but reported gaps in the use of biological safety cabinets (BSC). Attitudes reflected adherence to safety guidelines but highlighted challenges during work overload. Practices revealed strengths in BSC usage but weaknesses in consistent PPE use and incident reporting. A strong correlation was observed among KAP variables and safe handling practices.
Conclusions: The safe handling of cytotoxic medications is a crucial feature, and nurses can avoid issues for both themselves and their patients. Overall, the nurses reported good practices for handling CDs safely, however a significant number of the nurses still have fair and negative habits. Effective actions are required to improve the procedures followed by oncology nurses when handling cytotoxic medications safely.

Keywords: Knowledge, Attitude, Practices, Nurses, Safe handling, Cytotoxic drugs

INTRODUCTION

Safe handling of ADs are very important issues among the nurses working with cancer patients in at King Abdullah Medical City (KAMC) located in Mecca, Kingdom of Saudi Arabia. Health care workers (HCWs) in the field of medical oncology provide medical treatment for cancer patients using chemotherapy. Chemotherapeutic agents in this field are known as CDs, ADs and oncology drugs. They are used extensively in health care facilities to treat cancer patients.[1] CDs are hazardous to HCWs particularly nurses, clinical pharmacists and cleaners who may come in contact with these CDs during their daily work activities. Thus, the number of HCWs handling CDs is expected to increase with the increase in the number of new cancer cases requiring treatment with chemotherapeutic agents.[2]

The researcher evaluating the KAP of oncology nurses towards the safe handling of ADs in a KAMC, Makkah. Occupational exposure to antineoplastic agents and safe handling of CDs had gained a high concern among oncology nursing staff due to their potential health risks. Many organizations such as occupational safety and health administration (OSHA), have recommended guidelines for safe handling of CDs.[3]

Although guidelines for safe handling of CDs were introduced more than 20 years ago, contamination of both the working environment as well as the HCWs is still reported in several recent studies particularly in developing countries.[4] Oncology nurse handle chemotherapy medication should have high level of knowledge and practice. Furthermore, this study identifies the relationship between KAP of safe handling of CDs and selected variables. Moreover, this study identifies areas of concern that require further improvement in terms of safe handling of CDs.

The handling of patients' excrement, as well as the creation and delivery of CDs, are among the most significant occupational dangers for nurses working in hospital settings. Working conditions such as CD manufacture and administration, CD leak cleaning, patient excreta handling, and other occupational tasks pose the biggest harm to their health. CDs and related debris may be a source of occupational exposure in the pharmaceutical business during the production, administration, shipping, and storage of medicines, as well as when dealing with cytotoxic waste, transporting and disposing of rubbish, and cleaning up spills. The administration of oral chemotherapy medications may take place in two ways: intravenously or orally. CD exposure may occur during medication preparation and mixing, intravenous (IV) administration, or specialized administration methods such as intra-peritoneal, pleural or pericardial, and cerebrospinal fluid (CSF) administration. While in transit and while cleaning up spills or removing trash, it is important to be mindful of your surroundings.[5]

Background of the study

Healthcare workers (HCWs) who work in the field of medical oncology have the task of providing medical care to cancer patients who are undergoing chemotherapy treatment.[4] ANDs, CDs, and oncology pharmaceuticals are all terminology used in this industry to denote chemotherapeutic chemicals that target cancer cells.[6] Medications on CDs pose a threat to health-care personnel, particularly nurses and clinical pharmacists, as well as housekeeping staff, who may come into touch with these CDs during the course of their everyday tasks.[7] Approximately 11 million new cancer cases are detected each year throughout the world, with the number anticipated to climb to 16 million by the year 2025, according to the world cancer research fund (WCRF).[8]

It is anticipated that the number of healthcare professionals who handle CDs will increase in parallel with the number of new cancer cases needing treatment with chemotherapeutic agents in order to keep up with the rising number of cancer cases.[9] The term CDs refers to a broad range of chemical agents that are employed in the treatment of cancer. In the medical field, they are sometimes referred to as ADs, anticancer pharmaceuticals, or cancer chemotherapeutic therapy.[10] Because of their ability to kill tumor cells by interfering with cell division, they are a popular option for cancer treatment because of their effectiveness in destroying tumour cells.[11]

According to their chemical makeup and pharmacological effects, drugs that are harmful to the body may be divided into a variety of categories.[12] Separating alkylating substances from antimetabolites, antitumor biotics from topoisomerase inhibitors from mitotic inhibitors, and miscellaneous medicines are just a few of the subcategories that may be made. Nurses who handle and administer chemotherapy in cancer treatment are at increased risk of developing health problems as the use of chemotherapy in cancer treatment continues to increase.[13]

Nurses should be made aware of the dangers associated with chemotherapy, as well as how to protect themselves from the treatment's side effects, before administering it.[14] According to a recent investigation, healthcare personnel, as well as members of the general public, have been worried about the impact of hazardous pharmaceutical exposure on their long- and short-term health for more than 40 years.[15] Hazardous residues may escape from hospitals and patient care facilities because of insufficient or negligent treatment, and these residues may be traced back to the patients' homes. This is particularly true at children's hospitals and other pediatric facilities chemotherapy for cancer patients is a demanding medical procedure that requires a high level of expertise.[16]

Lack of knowledge of CDs, in addition to other factors, was shown to be a key cause of dangerous behavior by healthcare staff when dealing with CDs in a clinical setting. It is more important than ever before for medical employees and management to be more attentive and conscientious when it comes to rubbish collection and disposal. A thorough understanding of CDs is essential for health professionals in order to protect themselves, their patients, and public, through adoption of safe operating practices and public education about proper disposal of leftover medications after they have finished with them.[17]

Aim

The aim of this study was to investigate the KAP of oncology nurses towards the safe handling of CDs in the oncology center including oncology, hematology, chemotherapy units in a KAMC, Makkah.

METHODS

Research design, setting and participants

This study was a cross-sectional research design that was carried out at KAMC, Makkah. The study period was from July 2022 to June 2023. The study was beginning with survey to generalize results and included close-ended questions to collect detailed view from participants. The survey questionnaire was used to designate any research activity in which the researcher gathers data from a portion of a population for the purpose of examining the

characteristics, opinions, or intentions of target population.[18] The sample size includes from the 88 nurses working in oncology centers of the hospital, having at least one year of work experience assuming a minimum response rate of 50% and a confidence interval of ±5%. The selection of the sample was a non-randomized convenience sampling technique that involves examining the entire population. The inclusion criteria include working in KAMC for more than one year in Oncology center and those who are willing to participate in the study. The exclusion criteria will be those nurses with less than one-year experience in oncology center and who are not willing to participate in the study

Sample size

The sample size for the study was estimated using Epi info software program. For sample calculation, the following information considered the total number of oncology nurses is 110, confidence interval as 95%, and 5% margin of error. The total sample of the study was 88 to get this number the researcher added an extra 10% for incomplete answers.

Sample size $n=N\times[Z2\times p\times(1-p)/e^2]/[N-1+(Z2\times p\times(1-p)/e^2]$

N=Population size, Z=Critical value of the normal distribution at the required confidence level, p=Sample proportion, e=Margin of error

Tool of data collection

For the purpose of data collection, the survey instrument was designed based on the initial interviews carried out from the experts in the organization (oncology physicians, clinical pharmacist etc...), which helped in gaining an in-depth understanding of the situation and the elements at play. Reference was made to a few standardized questionnaires from Hanaa Zayed and coworkers, and specific survey questions were developed based on the requirements of the current scenario, which included the most items suitable to assess the KAP of oncology nurses towards the safe handling of ADs.[19] The survey questions consist of made up of two parts. First part of questionnaire represented socio-demographic characteristics of the participants: gender, age, educational level, total professional work experience and experience with oncology patients and formal training on safe handling of ADs. Others' part is represented survey questions related to KAP of oncology nurses towards the safe handling of ADs. Participants answered the questionnaire by Likert scale, which included knowledge as yes, somewhat, no and attitude as disagree, neutral, agree and practice as yes or no. Each questions answer was scored from 1-3 and total score calculated from each item of all areas.

Validity and reliability

The questionnaire was pre-tested for validity in a small sample (5-20 people) several times to ensure that wording, format, length and sequencing were appropriate based on expert opinion (e.g. medical professionals, and researcher experts). The reliability test was done by using Cronbach's Alpha method and make sure the instrument is reliable to measure the objectives of the study.

Table 1: Cronbach's alpha coefficient to measure the stability of the study tool.

Dimensions	Number of phrases	Cronbach's
D1: Knowledge	13	0.731
D2: Attitude	8	0.618
D3: Practice	12	0.594
The overall stability of the questionnaire	33	0.567

Ethical considerations

The study was started after getting official permission from the FCMS institutional review board and KAMC institutional review board appendix. The study required ethical approval to ensure that participant's rights are not violated. Verbal consent, freedom from harm and confidentiality are vital in this study. It is also important to ensure that the participants of the study felt no coercion or pressure from anyone to participate in the study. Each participant agreed to take part in the study before the researcher interacted with the subject or involved them in the study. The participants had the right to refuse taking part in the study without any penalty or negative feedback.

Data collection

The study started with survey in order to generalize results. The investigator collected data from the participants by using online survey questionnaires. The participants were made aware through the questionnaire that by submission of online survey would indicate their consent to participate. Participants were not identified on questions. Each participant agreed to take part in the study before the researcher interacted with the subject or involved them in the study. For ethical consideration, the aim of the study and an information part explaining the study details was included in survey to obtain their cooperation. A data sheet was provided before beginning to answer the questions, which included a description of the study purposes.

Informed consent

For this study, the participants were made aware through the questionnaire that by submission of online survey would indicate their consent to participate. Participants were not identified on questions. In this way the researcher, maintained anonymity and confidentiality of the participants. The nature of the data needed for study purposes were explained to participants and they have the right to enroll in this study without coercion and to withdraw from the study at any point.

Statistical analysis

The researcher used the software statistical package for social science (SPSS) version (25). The participant's demographics characteristics were described using frequency and percentages. The data analysis is done by measuring the mean and standard deviation of responses to each independent variable axis. Descriptive statistics was used to examine demographic data of the participants, while independent t-test was performed to examine possible differences in means between groups Person correlation was utilized to look at statistical relationship between the study variables as required in the hypotheses. P<0.05 was considered as significant.

RESULTS

A total of 88 nurses was enrolled in the research. As shown in Table 2, shows the gender and age categories of study participants, for gender, more than half of the respondents are female with 63 out of a total of 88 nurses/71.6% while male nurses account for 25 respondents or 28.4 percent. In age group, most of participants have age between 30-40 years (72%), remaining less than 30 years (17%), 40-50 years (9%) and 50-60 years (2%) respectively.

For educational attainment, the majority of the respondents, 86.4% have a bachelor's degree while 11.4% have a diploma in nursing and the remaining 2.3% have a master's degree. For the work experience in the nursing profession, the respondents have been in the profession for 6 to 10 years already, that is, 43.2%. Those who had been in the nursing profession for 1 to 5 years with 25% while the 11 to 15 years, 16 to 20 years, and 21 years or more follow next with 19.3%, 9 or 10.2%, and 2.3% of the respondents respectively. It can therefore be observed that most of the nurses are deployed in over a period that is often less than 10 years.

For year of work experience with oncology patients, 35.2% of respondents already have 6-10 years of experience working in hospital. It is followed by 3-6 years with 23.9%, more than 10 years 17% then less than 1 year with 13.6%, and finally 10.2% from 1-3 years. Lastly, for safe handling of ADs train, 83 out of 55 respondents, or 94.3% had attended training relevant while remaining 5 respondents have not attended any training yet.

Table 3 shows frequency distribution of each dimension of nurses knowledge on ADs, the results reached are the following: The greater means of this dimension were (1) for item (ADs are cytotoxic, I know how to use PPE correctly, I know safe ADs waste disposal methods), but the lowest mean value were (0.77) for item (I know correct use of BSC). The p value indicates some of the statement have association with nurse's knowledge on ADs.

Table 4 shows the frequency distribution of each dimension of nurses' attitude on ADs, the results reached are the following: The greater means of this dimension were (2.95) for item (I should pay attention to precautions in guidelines), but the lowest mean value were (2.65) for item (Handling of ADs in work overload condition is unacceptable). The p value indicates all the statement have association with nurses' attitude on ADs.

Table 5 shows frequency distribution of each dimension of nurses practice on safe handling of ADs, results reached are the following: The greater means of this dimension were (1.17) for item (I always prepare ADs in BSC), but the lowest mean value were (1) for item (I always wear PPE during preparation of ADs, I record and report all accidents in handling of ADs, consult clinical pharmacist about safe handling, consult physician about related health problems). The p value indicates some of statement have association with nurse's practice on safe handling of ADs.

Table 6 shows the Pearson correlation to determine the connection between independent variables with KAP oncology nurses towards the safe handling of ADs. The outcome reveals moderate positive and negative correlation between each one of the clusters, that is +1, -1 and the p value is computed at 0.000, which is less than 0.05 which means significant.

Table 1: Demographic characteristics of the participants, (n=88).

Variables	Categories	N	Percentage (%)
Gender	Male	25	28.4
	Female	63	71.6
Age (in years)	<30	15	17
	30-<40	63	71.6
	40-<50	8	9.1
	50-<60	2	2.3
Level of education	Diploma in nursing	10	11.4
	Bachelor degree	76	86.4
	Master degree	2	2.3
Total professional experience (in years)	1-5	22	25
	6-10	38	43.2
	11-15	17	19.3
	16-20	9	10.2
	21 or more	2	2.3

Continued.

Variables	Categories	N	Percentage (%)
Work experience with oncology patients (in years)	<1	12	13.6
	1 to 3	9	10.2
	3 to 6	21	23.9
	6 to 10	31	35.2
	More than 10	15	17
Trained for safe handling of ADs	Yes	83	94.3
	No	5	5.7

Table 2: Mean and standers deviation of the knowledge of ADs.

Statement	Mean	SD	Chi-square	P value
ADs are cytotoxic	1	0.00	-	-
I am aware of all routes of exposure to ADs	0.95	0.20	72.72	<0.00
I am aware of adverse health effects of exposure to ADs	0.97	0.18	76.40	<0.00
I know the management of adverse health effects of ADs	0.97	0.18	76.40	<0.00
I know guidelines and standards for safe preparation of ADs	0.95	0.20	72.72	<0.00
I know safe administration of ADs	0.98	0.15	80.18	<0.00
I know safe transport and storage of ADs	0.97	0.18	76.40	<0.00
I have to use BSC for all preparations	0.80	0.40	30.72	<0.00
I know correct use of BSC	0.77	0.42	26.18	<0.00
I know the management of accidents in handling of ADs	0.95	0.20	72.72	<0.00
I know all required PPE	0.99	0.10	84.04	<0.00
I know how to use PPE correctly	1	0.00	-	-
I know safe ADs waste disposal methods	1	0.00	-	-
Weighted mean and standard deviation of the whole dimension	12.29	1.36		

Table 3: Mean and standers deviation of the attitude of ADs.

Statement	Mean	SD	Chi-square	P value
Safe handling of ADs makes me sure that I am not at risk	2.75	0.55	89.61	<0.00
Use of PPE in handling of ADs is essential	2.91	0.32	136.93	<0.00
Handling of ADs in work overload condition is unacceptable	2.65	0.62	63.15	<0.00
Adverse health effects of ADs exposure are worrying	2.82	0.38	35.63	<0.00
I should handle ADs without hurry	2.80	0.57	116.34	<0.00
I should pay attention to precautions in guidelines	2.95	0.25	158.47	<0.00
I started my work in oncology with my willing	2.70	0.55	72.09	<0.00
I wish to continue my work in oncology with my willing	2.80	0.48	98.88	<0.00
Weighted mean and standard deviation of the whole dimension	22.37	2.02		

Table 4: Mean and standers deviation of the practice of ADs.

Statement	Mean	SD	Chi-square	P value
Always prepare ADs in preparation room	1.07	0.25	65.63	<0.00
I always prepare ADs in BSC	1.17	0.37	38.22	<0.00
I never do risky behavior (eat, drink, smoke...) in preparation room	1.01	0.10	84.04	<0.00
I don't store ADs in preparation room	1.13	0.33	49.50	<0.00
I follow standard guidelines for handling of ADs	1.01	0.10	84.04	<0.00
I always wear PPE during preparation of ADs	1	00	-	-
I always wear PPE during administration of ADs	1.02	0.15	80.18	<0.00
I always wear PPE during transport and storage of ADs	1.05	0.20	72.72	<0.00
I manage accidents as spills based on standard protocols	1.01	0.10	84.04	<0.00
I record and report all accidents in handling of ADs	1	00	-	-
Consult clinical pharmacist about safe handling	1	00	-	-
Consult physician about related health problems	1	00	-	-
Weighted mean and standard deviation of the whole dimension	12.46	0.95		

Table 5: Correlation between the study variables.

Variables	Knowledge	Attitude	Practice
Gender			
Pearson correlation	0.007	0.130	-0.089
Sig. (2-tailed)	0.947	0.228	0.411
Age (in years)			
Pearson correlation	0.083	0.125	-0.153
Sig. (2-tailed)	0.441	0.246	0.155
Educational level			
Pearson correlation	-0.062	-0.032	0.058
Sig. (2-tailed)	0.568	0.770	0.594
Work experience in profession			
Pearson correlation	0.020	-0.062	-0.069
Sig. (2-tailed)	0.854	0.563	0.520
Work experience with oncology patients			
Pearson correlation	0.138	-0.061	-0.029
Sig. (2-tailed)	0.200	0.575	0.789
Trained for safe handling of ADs			
Pearson correlation	-0.451**	-0.046	0.241*
Sig. (2-tailed)	0.000	0.672	0.024

**Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

DISCUSSION

The result regarding each statement of the study variables reported by the frequency of distribution. In the variable knowledge of ADs, the greater means of this dimension were for item (ADs are cytotoxic, I know how to use PPE correctly, I know safe ADs waste disposal methods), but the lowest mean value were for item (I know correct use of BSC). The p value indicates some of the statement have association with nurse's knowledge on ADs. This result is consistent with earlier research conducted by Turk et al and Alehashem who discovered that some nurses had sufficient knowledge.[4,20] However, these findings were lower than those of Sheikh's study, which was conducted at Kenyatta national hospital units and discovered that few healthcare workers handling CDs had sufficient knowledge.[21]

High levels of knowledge on CDs and the related negative health effects are essential to improving nurses' adherence to safety precautions.[22] According to other studies, nurses who have received training have knowledge that is greatly increased.[4,20,23,24] The current study revealed a strong association between nurses' knowledge of antineoplastic medications and their attitudes, which is similar to earlier studies.[4,25] that demonstrated the importance of raising nurses' knowledge levels. Additionally, research by Simegn et al indicates a high correlation between understanding of cytotoxic medication handling and safety.[12] One of the studies concurs that before giving chemotherapy, nurses should be informed of the risks involved with it as well as how to protect themselves from its negative effects.[14] A recent study on the subject found that workers in oncology facilities needed to be taught and given access to safety gear.[9]

In the next variables, attitude of ADs the greater means of this dimension were for item (I should pay attention to precautions in guidelines), but the lowest mean value was for item (Handling of ADs in work overload condition is unacceptable). The p value indicates all the statement have association with nurses' attitude on ADs. Which contrasts with the findings of Alehashem and Baniasadi, who found that the attitude score in their nurses was adequate. Additionally, there was a statistically significant correlation between the attitude of the nurses toward anti-cancer medications, which is consistent with Alehashem and Baniasadi's findings.[4]

In the third variable, practice of ADs the greater means of this dimension were for item (I always prepare ADs in BSC), but the lowest mean value was for item (I always wear PPE during preparation of ADs, I record and report all accidents in handling of ADs, consult clinical pharmacist about safe handling, consult physician about related health problems). The p value indicates some of the statement have association with nurse's practice on safe handling of ADs. In contrast to the findings about the level of nursing practice made by Alehashem and Baniasadi's study in Iran and Sheikh's study in Nairobi, the current study revealed that the practice grade was generally inadequate and did not strictly adhere to international standards.[4,21,24,26,27]

The oncology nurses who were the subject of the study had poor practices for handling CDs safely and poor execution of standards, which called for more regular in-service training and an audit system to track and assess their performance following training. The oncology nurses who were the subject of the study had poor practices for handling CDs safely and poor execution of standards, which called for more regular in-service training and an

audit system to track and assess their performance following training.[19]

The current study also examined the correlation between the independent variables with KAP of oncology nurses towards the safe handling of ADs variables and the outcome reveals a strong link between the study variables with safe handling of ADs. The Pearson correlation test result shows that dependent variable have positive correlation with others. This is similar to earlier studies.[4,25] that demonstrated how vital it is for nurses to increase their knowledge levels in order to change their attitudes. Moreover, Sheikh study found a statistically significant link between the scores of the various components (KAP).[21] According to a different study, nurses' proficiency in the safe handling of cytotoxic medicines is insufficient.[10]

Limitations

The present study has some limitations. Firstly, it discusses the KAP of oncology nurses towards the safe handling of ADs in a specialist hospital from their perspectives. It needs to be involved the other healthcare workers including physicians and pharmacist concerns also therefore the findings and recommendations might not be generalizable and applicable in institutions with significantly different operational policies and serving a population with different characteristics. Another limitation of this study was it covered only one specialist hospital in Makkah. Therefore, there is an opportunity to conduct a large survey in all other government hospitals in Saudi Arabia. This study relies on questionnaire survey additional qualitative or mixed methods might have enriched the findings. Finally, the data collections conducted on online platform and if possible, using nurse's interactions may find additional ideas and suggestions on safe handling of ADs that will help for improving the work autonomy in hospital settings.

CONCLUSION

The results of this study show that all variables statement have association with nurse's knowledge on ADs and the correlation result outcome reveals a strong link between the study variables with Safe Handling of ADs. Oncology nurses are advised to seek out formal training providers and information sources in order to gain sufficient, accurate, and useful knowledge on the safe use of ADs.

Recommendations

It is extremely important to educate nurses about how to handle CDs safely. It's also crucial to have supervision and training when working. Pre-employment and ongoing refresher training programs, particularly those from the American society of hospital pharmacist, national institute for occupational safety and health, and the occupational safety and health administration, are strongly advised for nurses who work with clinical pharmacists and occupational medicine specialists. All HCWs should have easy access to the guideline plan (occupational health and safety administration.

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