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ORIGINAL ARTICLE

Knowledge, Attitude, and Performance of Oncology Nurses Handling Antineoplastic Drugs in Hospitals of Urmia University, Iran

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ABSTRACT

Antineoplastic drugs (ANDs) for the treatment of cancers could result in the occupational exposure of nurses and consequent side effects. This study aimed to evaluate knowledge, attitude, and performance of oncology nurses and to survey nurses' chemotherapy workload and the experienced side effects. A cross-sectional study was conducted at four hospitals of Urmia University, Iran. Two self-reported questionnaires were distributed among 54 oncology nurses to collect information on nurses' workload and side effects as well as to evaluate their level of knowledge, attitude, and performance. Totally, 54 nurses were participated in the study. The mean age and chemotherapy work experience of nurses were 32.4±6.5 and 4.3±3.5 yr, respectively. Nearly 52% and 36% of nurses reported the lack of safety guideline and training program at their workplaces, respectively. Hair loss, headache, and period abnormalities were the most reported side effects of exposure with ANDs. All nurses prepared ANDs in biological safety cabinet but 85.5% and 37% of nurses used the respirator and eye protection during drug preparation. The mean score of knowledge, attitude, and performance of nurses was 9.43±1.5 out of 12, 39.14±6.5 out of 60, and 13.41±4.7 out of 23, respectively. The result clearly points to the fact that there is a need for implementation of guidelines and training in studied oncology units. Through the provision of proper personal protection and regarded training, hospitals could demonstrate organizational support leading to improvement of knowledge and performance as well as decrease of nurses' concerns in exposure with ANDs.

KEYWORDS: *Antineoplastic agents, Nurses, Knowledge, Attitude, Performance*

INTRODUCTION

Nowadays cancer patients are diagnosed earlier than in the past. They receive multiple courses of chemotherapy for a longer period of time [1]. Antineoplastic drugs (ANDs) are therapeutic agents used in the killing of cancerous cells, but their mechanism is not selective [2].

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In other words, they do not distinguish cancerous cells from normal ones, and more or less act on healthy cells too. International Agency for Research on Cancer (IARC) classified some of the ANDs as human carcinogens [3]. Health care workers who prepare or administer ANDs are at the risk of potential exposure to ANDs through contaminated work surfaces, drug vials and containers, contaminated clothing and medical

equipment, and patient excreta [4-5].

The chronic health effecting of ANDs are well documented in the past studies and include reproductive issues [6-7], genetic effects, and cancer [8-11]. Acute health effects such as hair loss, skin rash, eczema, skin flush, light-headedness, nausea, and dizziness have been reported by nurses who exposed to ANDs [1, 12]. Due to the adverse effects of exposure with ANDs, organizations such as National Institute for Occupational safety and Health administration (NIOSH), American Society of Hospital Pharmacist (ASHP), the Oncology Nursing Society [13], American Society of Clinical Oncology (ASCO), and Occupational Safety and Health Administration (OSHA) have recommended safe handling guidelines for ANDs [5, 14]. These guidelines recommend the application of hierarchy of control technologies to mitigate workplace hazards, which include engineering controls, administrative controls, work practice controls, and personal protective equipment (PPE) in order of decreasing effectiveness [15]. All healthcare workers who work with ANDs have been advised to adhere to these safety guidelines [14]. Although the previous studies documented the side effects of ANDs on exposed persons, healthcare workers often do not adhere to safe work practices [15-16]. This could be related to the lack of nurses' knowledge about routs of exposure and adverse health effects induced by antineoplastic drugs.

Knowledge and attitude of nurses regarding chemotherapy exposure maybe affect their adherence to safety measures, i.e. their behavior or performance when handling antineoplastic drugs. Previous studies have reported that there is a gap between nurses' chemotherapy knowledge and their behavior during work with antineoplastic drugs [15-18]. The availability of safe handling guidance for some time, recommended practices did not always follow by healthcare workers and the perception of respondents about themselves exposure was insignificant and it did not justify them to use protective gloves and gowns constantly [15]. Hon et al. studied the knowledge, perceptions, and behaviors of a range of healthcare workers regarding ANDs, found that there was a gap between knowledge and compliance with glove usage, and hand hygiene. They also reported the lack of awareness regarding risks of occupational exposure to antineoplastic drugs in some health care workers, especially transport, unit clerks and others in the drug administration unit [16]. Only 7.4% of nurses had received in-service education and the mean level of nurses' information in the protection of environment and self-protection were 7.82 from 14 points and 7.94 from 11 points, respectively [17]. The level of knowledge of the nurses about ANDs was not satisfactory and the nurses did not comply with safety regulation fully [19-20].

To our knowledge, there are a limited number of studies conducted on chemotherapy administration safety in Iran. Momeni et al. described the usage of PPEs and self-reported health effects of nurses working in some hospitals of Fars Province, southern Iran [21]. Afshar et al. conducted a study in nine specialized cancer centers in Tehran to evaluate the healthcare workers' understanding of occupational exposure to ANDs and occurrence of any side effects [22].

This study was conducted in four hospitals of West Azerbaijan Province, northwestern Iran, to evaluate knowledge, attitude, and performance (KAP) [1] of nurses during the administration of ANDs and also their chemotherapy workload and the experienced side effects.

MATERIALS AND METHODS

This cross-sectional study was carried out in June to August 2015 at four hospitals of West Azerbaijan Province, Iran in which the chemotherapy was administered throughout of the province. The participants consisted of whole nurses (54) who prepared chemotherapy, administered chemotherapy, or both. The nurses were from outpatient (16) and inpatient (38) oncology units.

Two self-reported questionnaires were used to collect data. The questionnaires were developed according to the previous cross-sectional studies [1-2, 17, 20, 23-25] and were discussed in a panel composed of nursing and occupational health specialists. The first questionnaire composed of four parts; 1) socio-demographic information such as gender, age, marital status, qualification, year of work experience in nursing and chemotherapy units; 2) the workload of nurses and the name of most common handled drugs; 3) the availability of ANDs handling workplace guidelines and also training and its source, and 4) the side effects experienced by nurses due to exposure to ANDs. The second questionnaire aimed to evaluate the level of knowledge, attitude, and performance of nurses handling ANDs. The knowledge section of the questionnaire contained 12 closed questions about possible exposure routs and the protection provided by PPE with response options of true, false, and do not know. Each correct answer was scored 1 point and the others were scored 0. Therefore, the possible score for knowledge of nurses ranged 0-12. The attitude section of the questionnaire composed of 15 items and the responses were given on a 4-point Likert scale of strongly agree/agree/disagree/strongly disagree, addressing the attitude of nurses towards ANDs exposure and the status of provided safety measures. Any respondent, therefore, could achieve an attitude score in the range 15-60. The

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performance of nurses was assessed by 23 items with closed answers of "yes" and "no" that were related to the use of PPEs and personal hygiene during preparation, administration, disposal, and cleaning of spills of ANDs. The adherence to each item received a score of 1, yielding the full score of 23. Internal reliability for KAP variables was determined based on the Cronbach's alpha coefficient, which was 0.74, 0.68, and 0.79, respectively.

Data were analyzed using SPSS19.0 (Chicago, IL, USA). Descriptive statistics (frequencies and percentages) were used to illustrate the socio-demographic characteristics and workload of nurses, and their KAP scores. The KAP scores were evaluated whether they followed the normal distribution by the Shapiro–Wilk test. Since the KAP scores did not fit the normal distribution, the Kruskal–Wallis test was performed for the comparison of more than two groups. Statistical significance was considered when $P<0.05$.

Ethical consideration was obtained from the Ethics Committee of UMSU (approval no. 1394-0-33-1693). Before the survey, participants were told the purpose of the study. All subjects were participated in the study with their own consent.

RESULT

Fifty-four nurses participated in this study. The characteristics of the study population are summarized in Table 1. The majority of nurses (92.6%) were female. The mean age of nurses was 32.4±6.5 yr (age range 23-47 yr). Most of the nurses were married and worked in the cyclic work shifts. The mean of chemotherapy work experience of nurses (4.3±3.5) was less than their nursing work experience (7.7±5.4).

More than half of nurses (52.3%) reported that there was safety-handling guideline in their workplaces. About 36% of nurses claimed that they did not receive any training on chemotherapy safe handling and 64% of them received training from different sources; 27% trained by their supervisors, 18% by coworkers and about 19% received information about ANDs through self-study using journals, books, and the internet. The self-reported symptoms among nurses were different; hair loss (68%), headache (36%), period abnormalities (36%), nausea (31%), fainting (22%), and skin problems (18%).

The frequency of preparation and administration of ANDs are presented in Table 2. All nurses worked with ANDs more than half of a week. Most of them worked with chemotherapy drugs at five (35.2%) and six (38.9%) days of a week, implying continuous exposure of most nurses with ANDs. The number of preparation sessions of drugs is different among nurses. More than half of nurses (68.5%) prepared drugs three and more than three times a day, showing the repeated exposure of nurses with drugs in a day. None of the nurses worked with a single drug and more than half of nurses (63%) worked with four and more than four medications, indicating exposure of nurses with different types of drugs. Adriamycin, cyclophosphamide, vincristine, cisplatin, etoposide, paclitaxel, ifosfamide were the name of the most common used ANDs reported by nurses in the surveyed hospitals.

Table 1. Characteristics of participants

Variable	n(%)	Mean (SD)
Gender		
Male	4 (7.4)	
Female	50 (92.6)	
Age (yr)		32.4 (6.5)
Marital Status		
Single	14 (25.9)	
Married	40 (74.1)	
Educational level		
Associate degree	3 (5.6)	
Bachelor degree	51 (94.4)	
Type of work shift		
Only morning	18 (33.3)	
Cyclic shift	36 (66.7)	
Nursing work experience (yr)		7.7 (5.4)
Chemotherapy work experience (yr)		4.3 (3.5)

Table 2. The frequency of preparation and administration of antineoplastic drugs

Frequency	n(%)
How often do you work with chemotherapy drugs?	
1 and 2 days/Week	0 (0.0)
3 days/Week	8 (14.8)
4 days/Week	6 (11.1)
5 days/Week	19 (35.2)
6 days/Week	21 (38.9)
How many times a day do you prepare medication?	
1 and 2 times/Day	17 (31.5)
3 and 4 times/Day	14 (25.9)
5 and more times/Day	23 (42.6)
How many medications do you administer each day?	
One medication	0 (0.0)
Two medications	8 (14.8)
Three medications	12 (22.2)
Four medications	10 (18.5)
Five or more medications	24 (44.5)

Table 3 shows the use of safety measures reported by nurses during preparation, administration, disposal of wastes, and cleaning of spills activities. All nurses prepare ANDs in biological safety cabinet (BSC) which could be effective in reduction of exposure to drugs. Respiratory and eye protection are the most (85.5%) and the least (37%) used PPE during the

preparation of ANDs, respectively. During the administration of drugs, nurses mostly used respirators (92.6%) and similar to the preparation, the use of eye protection was at the end of the list (16.7%). Double gloves were used more than other PPE during disposal of wastes and the use of PPE during cleaning of spills was reported less than other activities on average.

Table 3. Use of safety measures reported by nurses during work with antineoplastic drugs

	Preparation of ANDs n (%)	Administration of ANDs n (%)	Disposal of wastes n (%)	Cleaning of spills n (%)
BSC use	54 (100.0)	-	-	-
Double gloves	32 (59.3)	29 (53.7)	40 (74.1)	23 (42.6)
Respirator	46 (85.2)	50 (92.6)	28 (51.9)	28 (51.9)
Gowns	25 (46.3)	18 (33.3)	19 (35.2)	17 (31.5)
Eye protection	20 (37.0)	9 (16.7)	11 (20.4)	11 (20.4)

Table 4 presents the descriptive statistics for KAP of nurses handling chemotherapy drugs. The scores on the chemotherapy exposure knowledge ranged 7-12 (M= 9.43, SD= 1.5). The two items that nurses lacked knowledge about were; "A surgical mask provides protection from chemotherapy aerosols" and "Alcohol hand sanitizer is as effective as soap and water in removing chemotherapy residue". These two items were incorrectly answered by 47.7% and 65.9% of nurses, respectively. Dividing the full score of knowledge (12) into three 4-point intervals (indicating the low, medium, and high levels) showed that 20.5% and 79.5% of nurses had the medium and high level of knowledge, respectively. Therefore, about 80% of nurses had acceptable knowledge about chemotherapy exposure. The attitude of nurses towards chemotherapy exposure achieved the range 30-51(M= 39.14, SD= 6.5). On average, 21.2%, 30.6%, 36.1%, and 12.1% of nurses responded strongly agree, agree, disagree, and strongly disagree options on attitude questionnaire, respectively. Dividing the full score of attitude (60) into three 20-point intervals indicated that 63.3% and 36.4% of nurses had the medium and high level of attitude, respectively. There was not any respondent in the low-level categories of both knowledge and attitude. The performance of nurses in the use of PPE during chemotherapy activities gained the scores ranged 7-23 (M= 13.41, SD= 4.7). Dividing the full score of performance (23) into three 8-point intervals revealed that 25%, 50%, and 25% of nurses had the low, medium, and high level of performance, respectively. The inattention of nurses in the use of eye protection during administration, disposal of wastes, and cleaning of spills and maybe the absence of spill kit were the items that lowered the score of nurses' performance.

Table 4. Descriptive statistics for knowledge, attitude, and performance of nurses handling chemotherapy drugs

Variable	Mean	SD	Possible score	Observed score
Knowledge	09.43	1.5	0-12	7-12
Attitude	39.14	6.5	15-60	30-51
Performance	13.41	4.7	0-23	7-23

Table 5 presents the mean rank for knowledge, attitude, and performance scores among groups of age and chemotherapy work experience as demographic variables. The Kruskal-Wallis one-way ANOVA on ranks showed that only the attitude of nurses differed significantly among chemotherapy work experience categories. The scores of knowledge, attitude, and performance did not significantly differ among age groups.

Table 5. Mean rank for the score of knowledge, attitude, and performance of nurses among age and chemotherapy work experience categories

Age (yr)	n	Knowledge	Attitude	Performance
23-28	19	20.5	23.7	22.0
28-33	17	28.6	24.7	24.3
33-42	18	18.7	19.2	21.3
P_{value}		0.08	0.46	0.80
			Chemotherapy work experience (yr)	
<2	16	18.8	28.6	21.5
2-5	13	29.9	26.7	27.1
>5	25	20.3	15.6	20.3
P_{value}		0.06	0.008	0.32

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DISCUSSION

This study aimed to evaluate the KAP of nurses on the handling of ANDs. Similar cross-sectional studies were conducted on nurses who handle ANDs in neighbor countries [17, 20, 26-27]. Accordingly, half of the nurses reported that the safe handling guidelines were not available in their workplace. Since the numerous international guidelines have been provided for safe handling of antineoplastic drugs, provision of guidelines in chemotherapy units of the current study is recommended as an urgent action. Besides safety guidelines, training of at-risk personnel, as an administrative control, should be scheduled and carried out.

In this study, a noticeable fraction of nurses (36%) reported the lack of any training program at work. Nine percent of nurses did not receive any training [28]. In a study in Jordanian hospitals [14], 66.7% of nurses received training on handling chemotherapy medication, which is similar to the results of the current study. Training in the safe handling of drugs could influence the health of nurses because the level of Cyclophosphamide in the urine of nurses who had not received training was higher than nurses who had [29]. Hospitals and clinics must provide safe handling education and training to improve the knowledge of staff and also to demonstrate the organizational support [24]. Polovich described some responsibilities of an employer for establishing a comprehensive safe handling program including reviewing guidelines regularly, developing policies based on guidelines, training of staff and monitoring of adherence to guidelines. Therefore, in the hospitals of this study, specific attention should be paid to the establishment of safety guidelines and training of all nurses handling ANDs.

The side effects of ANDs have been reported by nurses in different studies [1, 13, 21-22]. Hair loss, headache, and period abnormalities were the most common experienced symptoms in the current study. These symptoms also reported by Kyprianou et al. [1] as the most common symptoms of nurses handling ANDs. In a study, the adverse effects of central nervous system (CNS) such as dizziness, nausea, and headache were mostly reported by Greek nurses. In addition, the majority of reported symptoms were positively correlated with both the number of drugs handled and the occurrence of the accident [13]. Headache and skin reactions were reported as the acute side effects of exposure with ANDs in two previous studies conducted in Iran [21-22]. Reported symptoms by nurses maybe due to the exposure to drug pollution during chemotherapy handling activities. Application of engineering and personal protections could reduce the degree of exposure.

In the current study, more than 70% of the nurses worked daily with ANDs, implying the continuous exposure of nurses with ANDs. Noticing the daily exposure of most of nurses and referring to this that about 68% of nurses prepared drugs three and more than three times a day, nurses maybe at increased risk of exposure to ANDs. In a study of healthcare workers exposure to antineoplastic drugs in the US, despite following the recommended safety guidelines, workplace contamination with these drugs was detected and 3 of 68 urine samples were positive for one drug [30]. In a Polish hospital under normal working conditions, cyclophosphamide was detected in the urine samples of three nurses from four studied [31]. Since different types of ANDs are available in oncology wards, nurses maybe expose with the variety of them. Sixty-three percents of nurses of the current study worked with four and more than four medications each day, while 57% of nurses were worked with four and more medications a day [3]. Among the most common ANDs used in the hospitals of the current study, cyclophosphamide and etoposide belong to the Group 1 IRAC classification, carcinogenic to humans, and adriamycin and cisplatin are classified as Group 2A, probably carcinogenic to humans [3]. Therefore, safety measures should be practiced by all nurses during work with ANDs and the monitoring of surface contamination should be planned to determine the polluted work areas.

In the current study, the level of KAP of nurses was evaluated. The mean score of chemotherapy exposure knowledge (9.43 out of 12) indicated that the majority of nurses were aware of routes of exposure to ANDs. Insufficient knowledge in "the protection provided by a surgical mask" and "the effectiveness of an alcoholic hand sanitizer" decreased the score of knowledge noticeably. Since nearly all nurses used surgical masks as the respiratory protection and were not aware of its degree of protection, the increase of knowledge in this area appears essential. In the future training program, the ineffectiveness of the alcoholic hand sanitizer in removing chemotherapy residue should be explained to nurses. "The protection provided by a surgical mask" and "the effectiveness of an alcoholic hand sanitizer" were answered incorrectly by 40% and 15% of nurses, respectively [25], while in the current study these percents were 47.7 and 65.9, respectively. The study of Turk et al. showed the lack of nurses' knowledge in two topics; properties of antineoplastic drugs and prevention. In-service training is an effective tool for the increase of knowledge level in nurses [20]. In Malaysia, the mean score of nurses' knowledge increased from 45.5 to 73.4 out of 100 after implementation of a pharmacist-base intervention that included courses and training workshops and

guideline update. Totally, the level of chemotherapy exposure knowledge in 80% of nurses of the current study was acceptable (score >8), however, the establishment of systematic training programs could increase its level.

The mean score of nurses' attitude was similar to the mean score of knowledge when the ratios of mean to maximum possible scores were compared (9.43/12≈39.14/51) but the majority of (79.5%) nurses had a high level of knowledge, whereas about 38% of nurses had high level of attitude. Polovich and Clark noticed the importance of training and education of nurses that not only could increase the level of knowledge but also could demonstrate the organizational support [24]. Therefore, training on exposure routes and the level of protection provided by each type of PPE could improve the attitude of nurses and decrease their concerns about side effects due to work with drugs.

In this study, the safe working practices with ANDs and use of PPE during preparation, administration, disposal of wastes, cleaning of spills, and hand washing, avoiding eating and drinking in the workplace were translated into the performance of nurses. Based on the results, the performance score was at the medium level (13.41 out of 23). All nurses prepared drugs in BSC while they used the respirator and eye protection as the most and the least frequent PPE, respectively. In another study, the rank of respirator and eye protection usage during drug preparation was similar to the current study [1, 20]. Since the preparation of drugs in wards could result in contamination of BSC and gloves [30, 32], and the drug preparation was determined as the stage with the highest average contamination [33], it is recommended that the preparation be done in pharmacy units of the current study. The pharmacists used more protection than nurses did during drug preparation [34-35]. The rank of PPE use in the administration of drugs is similar to the drug preparation. It implies that specific attention should be paid to the use of eye protection. The frequent use of double gloves in the disposal of wastes maybe show the perceived protection provided by this PPE by nurses. Nurses reported that there was not any special kit for cleaning of spills. In other similar studies, nurses reported the availability of spill kits in their workplace [15, 36]. For better management of spills in the accidental release, the presence of suitable kit is necessary and is recommended for the studied hospitals [5]. Again, the role of training is important in the improvement of nurses' performance. Keat et al. reported the improvement of practice score from 7.6 to 15.3 out of 20 in Malaysian nurses due to a series of technical, educational, and administrative support measures [2]. Therefore, continuing education should be provided for chemotherapy nurses as its importance has been highlighted in Korean nurses [37].

According to the statistical analysis provided in Table 5, the younger and the older nurses did not have a significant difference in their knowledge, attitude, and performance scores. It could be implied that younger nurses may not receive information about ANDs than older ones and consequently did not change their attitude and performance level. Working in chemotherapy units influenced the attitude of nurses negatively and the experienced nurses had a lower score of attitude than novice nurses. Opposite to this study, in the study of Jeong et al., nurses' awareness was statistically different among work experience categories during preparation, administration, and disposal of drugs but agreed with our results the performance score did not statistically differ [37].

CONCLUSION

There is a lack of safe handling guidelines in the studied chemotherapy units, and hence they should be updated and provided in all units. Implementation of good engineering controls and good work practices could reduce the occupational exposures of nurses. Provision of proper PPE, implementation of safety guidelines and systematic training programs could demonstrate the organizational supports and reduce the concerns of nurses during work with ANDs. Environmental and biological monitoring, as complementary actions, will provide information for the better management of risks induced from ANDs. The accomplishment of all recommended measures will provide a safe and healthy work environment for chemotherapy nurses and will result in the increase of their knowledge, attitude, and performance.

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