

Original Research Article

Evaluation of knowledge and practice of handling chemotherapy agents by nurses: a multi-centre studies in Bangladesh

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ABSTRACT

Background: Along with several significant factors in chemotherapy treatment management's nurses plays the pivotal role. The objective of this study was to evaluate the knowledge of nurses in relation to handling chemotherapy agents and the current practice of cancer centers in different hospitals in Bangladesh.

Methods: The cross-sectional study was designed based on anonymous self-administered questionnaire. The questionnaire was developed from literature and expert input and validated by subject experts.

Results: A total of 96 nurses were the respondents in this study. Around half of them already exposed directly with chemotherapy agents. Some 72.9% of nurses had not any training and 58.3% of respondents were not aware about use of closed system transfer devise in chemotherapy. A greater proportion 58.3% of nurses did not know the same health hazard of both oral and parenteral drugs. One third (33.3%) respondents used biological safety cabinet for doing preparation. Nurses' did not use especial personal protective equipment and the designed treatment room also was absent. None of nurses went through regular medical checkup.

Conclusions: The evidence-based results suggested that nurses have average knowledge about chemotherapy handling, however, use of personal protective equipment and biological safety cabinet, follow guidelines, medical surveillance and training are appeared to be a hindrance. More fundamentally, nurses need more education and professional training about chemotherapy agents handling in nursing school and through in-service continuing education as well as adopt required facilities are necessary.

Keywords: Chemotherapy agents, Nurse, Knowledge, Biological safety cabinet, Personal protective equipment

INTRODUCTION

It has been more than a decade that chemotherapy agents have been using against cancer diseases to kill cancer cells by interfering with cancer cell division. Extensive use of chemotherapy drugs cause increased amount of health hazards among healthcare workers who has prepared and administered chemotherapy drugs.^{1,2} Since, chemotherapy agents contain a toxic property that is why it may cause carcinogenic, teratogenic and mutagenic

effects on human body.³⁻⁹ Chemotherapy agents might also cause abortion, fetal abnormalities, fertility problem and genetic changes in off-spring (OSHA). Oncology Nursing Society recommended that nurses' must be qualified to handle chemotherapy agents and possess knowledge of risks about their workplace. The level of contamination and risk also depends significantly on knowledge and awareness of the practitioner. That's why nurse's knowledge on the handling of chemotherapy agents remains a great concern because this is closely

associated with promotion of safety standards. Nursing education was mandatory for every oncologic nurse to improve their knowledge.^{9,10} The more they earn knowledge, more they adhere to the use of safety measures to treat patient which enhances the chances of healthy live. Study showed that patient who had received chemotherapy agents and those who were within treatment chain both had suffered from side effects depending on the drugs and personal protective measures.¹¹ Health risks of occupationally exposed person may depend on precaution, drug toxicity, individual exposure and lack of proper knowledge. Other ways of exposure to chemotherapy agents were subsumed inhalation of aerosolized droplets, dermal absorption, ingestion and rarely needle prick injury.¹² A study showed that exposure risks of oral chemotherapy agents were as same as sterile intravenous agents for the patients, nurses and caregivers.¹³ The literature review showed that use of appropriate protective measures was highly recommended during preparation and handling of chemotherapy agents for preventing the exposure of the health-care workers.^{14,6,15} There are different guidelines from various organizations such as National Institute for Occupational Safety and Health (NIOSH), the Oncology Nursing Society (ONS), the Occupational Safety and Health Administration (OSHA), the American Society of Health Pharmacists (ASHP).¹⁶ There were some barriers of using necessary precautionary materials and equipment due to inconvenience and limited time, awkward positions, unavailability and access of equipment.¹⁷ In addition, lack of knowledge and awareness about health hazards including handling of chemotherapy agents not feeling comfortable to use them because of excess work pressure and thinking that no need for using such protective equipment had also been reported.^{18,19} A further study reported that there was a distinction between the knowledge and real attitude of nurses regarding potential hazards of chemotherapy agents and the use of protective measures.⁶ Keeping them engaged in mandatory update of safety rules and continuous education were major tools for nurses to be competent.²⁰ Occupational exposure could be eliminated by following proper procedures and using of appropriate equipment such as fume hoods, exhausted biological safety cabinets (BSC) for handling chemotherapy agents.²¹ Nurses are the key person for preparing chemotherapy agents and administering to the patients in oncology department. Hence, assessment of nurse' knowledge for safe handling practice is highly required. Therefore, the study was conducted for assessing nurses' knowledge in chemotherapy handling and present practices in different cancer center of various hospitals in Bangladesh.

METHODS

Study design

A cross-sectional survey was carried out among nurses in chemotherapy unit in public and private hospitals covering entire Dhaka city from October 2018 to

December in 2018. Respondents sampling was designed based on working experience in chemotherapy unit.

Sample

The survey was conducted on 96 registered nurses who were working in chemotherapy department were asked to take part in this study. Initially, the questioner has been distributed to 110 nurses and among them 96 completed then gave return to the researcher. The criterion for inclusion comprised of: (a) each object was engaged in handling of chemotherapy agents in the period of data collection; (b) with at least 6 months experience of working in chemotherapy unit.

Data collection

Data were obtained based on an anonymous self-administered questionnaire. The questionnaire consists of 25 items and all of them were very basic which was reviewed by academician and chemotherapy experts. It was distributed to all respondents and took return similarly in order to ensure confidentiality. The questionnaire consist three parts with a clear subtitle for each. First section of the questionnaire covered socio-demographic data-sheet, including age, gender, education, year of experience as registered nurse and as a nurse of chemotherapy unit, training and type of hospital they worked for. The second section of questionnaire aimed at evaluating the level of knowledge about chemotherapy agent preparation, standard procedures, administration, personal protective equipment (PPE), waste disposal and safe handling measures. The knowledge section contained 15 items with response option of true, false and not known, yielding a probable score of 15. The third section mainly determines their current practice towards standard procedure of chemotherapy agents handling, equipment used for preparation, and hospital policies for medical surveillance and direct exposure experience which consisted of 10 items. In this section, each question was given options of 'yes' and 'no', and yielding possible total score of 10. Individual correct answer received a score of one for correct response and 0 for incorrect and not known.

Data analysis

Data were analyzed by using the statistical package for Social Science (SPSS), version 16 Ink. Data distributions of all variables were checked before starting the analysis. Descriptive statistics was used for data analysis. A p-value of 0.05 or less was chosen to determine statistical significance for statistical analysis.

RESULTS

Description of participants

There were 96 respondents who participated in the survey and majority of them were 89 (92.7%) female rest of

were male. The age of respondents did vary. Some 40 (41.7%) of nurses were in between 18-25 years age, 33 (34.4%) were in 26-32 years and 23 (24%) of them were above 33 years of age. Most respondents 88 (91.7%) had a minimum qualification i.e. diploma and remaining 8 (8.3%) had bachelor degree in nursing from different nursing schools. Majority 70 (72.9%) of respondents did not obtain any training regarding chemotherapy agents handling, however, 26 (27.1%) were reported to have enough skill to handle chemotherapy agents. Researcher found that the nurses significantly differed in having any special training on chemotherapy agents handling even they did not attain any seminar, symposium and workshop. Working experience in chemotherapy units of respondents' shown that majority of them 63 (65.6%) had between 0.6-4 years, 22 (22.9%) between 4-8 years and while 11 (11.5%) had more than 8 years. Among the respondents 15 have worked in other unit before starting to chemotherapy unit. It also showed that the most of the respondents 84 (87.5%) had worked at private hospitals and the remaining 12 (12.5%) worked at public hospitals (Table 1).

Table 1: Socio-demographic variables of the respondents (n=96).

Variable	Frequency (%)
Age (years)	
18-25	40 (41.7)
26-32	33 (34.4)
>33	23 (24)
Gender	
Male	7 (7.3)
Female	89 (92.7)
Professional qualification	
Diploma	88 (91.7)
Bachelor	8 (8.3)
Masters	0 (0)
Experience (years)	
0.6-4	48 (50)
5-8	21 (21.9)
>8	27 (28.1)
Experience in chemotherapy unit (years)	
0.6-4	63 (65.5)
5-8	22 (22.9)
>8	11 (11.5)
Training on chemotherapy handling	
Yes	26 (27.1)
No	70 (72.9)
Type of hospital	
Private	84 (87.5)
Government	12 (12.5)

Knowledge of the respondents

The study examined the knowledge of the respondents regarding chemotherapy agents handling and safety measures have been taken while working in

chemotherapy unit. The minimum and maximum knowledge score on chemotherapy agents handling was 8 and 15 respectively. Most of the respondents 88 (91.66%) had good level of knowledge their score was 11-15, and the minority i.e., 8 (8.34%) nurses' scored range 5-10. Therefore, it is established that their knowledge score was in satisfactory level. Majority 56 (58.3%) respondents were not aware about the use of closed system transfer device (CSTD) for preparing chemotherapy drugs. Regarding the risk of oral chemotherapy exposure, 56 (58.3%) respondents mentioned that oral and intravenous drugs do not have same hazardous effects and 12 (12.5%) were not aware about the exposure risk. Some 31 (32.3%) nurses had lack of knowledge about use of sterile 70% isopropyl alcohol for decontamination of bio-safety cabinet. Around 12 (12.5%) had not possessed use of powder free gloves during preparation (Table 2). The study reported that most respondents had required knowledge for handling of chemotherapy agents. Nevertheless, they had not adequate knowledge about use of personal safety equipments.

Table 2: Knowledge of respondents on chemotherapy agents handling (n=96).

Aspects	Frequency (%)		
	True	False	Not known
Close-system transfer devices	36 (37.5)	4 (4.2)	56 (58.3)
Same exposure risks of oral drugs as injectable	28 (29.2)	56 (58.3)	12 (12.5)
70% isopropyl alcohol used for decontamination	64 (66.7)	1 (1)	31 (32.3)
Use of powder free hand gloves	80 (83.3)	4 (4.2)	12 (12.5)

Current practices

The study revealed that majority of respondents 62 (64.6%) reported that they did not have any standard operating procedure (SOP) for preparation, administration, spill management and waste handling of chemotherapy agents while following standard guidelines. In this study, 38 (39.6%) of respondents revealed that there were not a dedicated room or area for preparation of chemotherapy agents while majority 58 (60.4%) reported that they use a particular room for purpose of admixture. Ninety six (100%) respondents mentioned that they did not have special designed room or area with appropriate ventilation system where they prepared chemotherapy agents. About two third 64 (66.7%) of respondents prepared chemotherapy agents in the biological safety cabinet (BSC) or in laminar air flow while 32 (33.3%) did not use any equipment. Nurses did not use any special design personal protective equipment as precautionary measures during handling chemotherapy

agents (CA). Nevertheless, they used surgical mask, gown and gloves during preparation of CA. All (100%) respondents reported that hospitals had no policy for health checkup for the workers who were providing healthcare service in chemotherapy unit. This study showed that 45 (46.9%) of nurses have already been exposed directly with chemotherapy agents through different way such as needle pick etc. at least once in their professional carrier (Table 3). A significant number of respondents reported that though they did not have any SOP for chemotherapy waste disposal but more often they attached label 'Hazardous item' on the plastic packet of chemo wastes. None of respondents smoke in the preparation area, while 27 (28.1%) of respondents had food and drink in the administration area.

Table 3: Handling practice of chemotherapy agents (n=96).

Aspects of practice	Frequency (%)	
	Yes	No
SOP of CA handling	34 (35.4)	62 (64.6)
Dedicated room for preparation of CA	58 (60.4)	38 (39.6)
Proper ventilation in preparation area	0 (0)	96 (100)
Biological Safety cabinet use	32 (33.3)	64 (66.7)
Chemo especial PPE use	0 (0)	96 (100)
Regular Medical checkup	0 (0)	96 (100)
Exposed directly with CA	45 (46.1)	51 (53.9)

SOP: Standard operating procedure), CA: Chemotherapy agent.

DISCUSSION

As per our knowledge, this is the first study about knowledge and practices of nurses on handling of chemotherapy agents and safety measures in Bangladesh. We evaluated nurses' level of knowledge both in concern of chemotherapy agents handling and following international safety guidelines in practice. Most of the respondents were aware about precautionary measures is needed for handling chemotherapy agents but in response to some items they were not well concerned. In Bangladesh, diploma degree was the only option to be educated in the field of nursing service. Hence, most of respondents (91.7%) were diploma qualified in nursing. It is noted that for a long time there was not any opportunity for certified graduate nursing program. However, recently, some nursing schools have introduced bachelor degree programs. Researcher determined that knowledge is inevitable for safe nursing practice, and it becomes essential when inadequate knowledge threatens personal safety of the nurse and that of the patient.²² In our study both public and private hospitals nurses were aware about the use of surgical gloves, mask, gown, and cap; but they didn't know about the use of chemotherapy especial gloves and latex free double gloves. Moreover, most of the respondents were not concerned about the use of side shield goggles during preparation. About 12.5%

respondents mentioned that using of latex free gloves is not required for handling chemotherapy agents. One study showed that in a chemotherapy center medication error was a common (44%) incidence owing to lack of specific knowledge and training of the worker in chemotherapy preparation and administration.²³⁻²⁵ In service training was the foremost source for getting information for healthcare worker.⁹ It was found that none of respondents attended to special training program on safe handling practices and safety measures needed for chemotherapy treatment. Closed-System Transfer Devices (CSTD) was designed for preventing contamination into environment during transferring drugs from vial to syringe and minimizing occupational exposure to chemotherapy drugs (Power, 2006).²⁶ In the current study, a greater number of respondents were unknown about CSTD and none of them knew the necessity and purpose of these devices for using. According to National Institute of Occupational Safety and Health, closed-system transfer device is mandatory for the preparation and administration of sterile doses of chemotherapy and hazardous drugs. For decontamination of Biological safety Cabinet (BSC), sterile 70% isopropyl alcohol was used along with other solution.^{20,27} A significant number of respondents in our study reported that they had not aware about the use of sterile 70% isopropyl alcohol for decontamination of BSC. In previous research it mentioned that the misconception were emerged about oral chemotherapy agents having low exposure risk in comparison to intravenous drugs and were safer to handle.²¹ This research revealed that similar wrong perception belongs to the majority (58.3%) of respondents. Even they didn't use hand gloves and mask during administration of oral drugs to the patients. An established practice is practiced for many years that pregnant healthcare worker should not handle chemotherapy agents because it may have carcinogenic, teratogenic and mutagenic to the fetus (NHS). This study revealed that (8.3%) respondents thought chemotherapy agents might be handled by pregnant women. This study has also pointed out that most of the nurses own required knowledge for proving healthcare care service.

Standard operating procedure (SOP) is essential in every steps to ensure the drugs safety, patient and healthcare provider safety as well environmental protection when handling chemotherapy agents and its waste in chemotherapy units. Moreover, the SOP is needed to design according to international guidelines. Healthcare providers often did not adhere to safe handling practice though the previous research mentioned the side effects of chemotherapy agents.^{28,29} Most of the respondents mentioned that for safe handling of chemotherapy agents, SOP is mandatory for working in cancer center but majority 66.7% of them never followed in practice. Nursing practices poorly complied with guidelines as a result environment was being contaminated by hazardous agents.³⁰ This is evident that there is a gap between guidelines and practices. Despite having knowledge and awareness as well as concerned about these issues, many

nurses didn't follow the guidelines and procedures in the healthcare setting.³¹ This research has shown majority of nurses did not follow guideline for preparation and waste disposal of chemotherapy agents in daycare unit. In addition, chemotherapy agents prepared in the normal room condition without maintaining proper cleanliness procedure and following standard guidelines. A designated treatment area is essential for safe handling practice of chemotherapy agents and the agents should be prepared in the BSC in that area. It was reported that 99% of chemotherapy center used laminar air flow hoods to prepare hazardous agents.³² In this study, 66.7% nurses' never prepared drugs in the BSC resulting high risk of exposure as well as environmental contamination. Personal Protective Equipment (PPE) such as two pairs of disposable latex free nitrile gloves that are FDA approved and tested, safety goggles, disposable protective gown with solid front with long sleeves and knit cuffs, long pants or long skirt, especial face shield and closed shoes must be worn while working with chemotherapy agents²⁰. None of respondents in our study used all approved PPE for handling chemotherapy agents. For keeping safe from exposure of hazardous agents personal protective equipment is needed such as gloves, safety glasses and shoes, earplugs, respirators or coveralls, vests and full body suits (OSHA). In the current study, nurses didn't use special PPE designed for chemotherapy handling. In some cases, even they didn't use surgical gown, cap and cloths' apron while worked with chemotherapy agents. It was evident that a little number of the studies mentioned that nurses had undergone regular medical checkup.⁹ This ascertained the finding of the present research has differed which revealed that none of the respondents went through for regular health checkup. Safety protocol for handling, for administration of chemotherapy agents and patient care after treatment, such measure includes using hygiene practices for instance by avoiding eating every kind of food, drinking and smoking in the area where agents have been prepared and administered to prevent direct contact with drugs (HSE). The majority of nurses were aware about having or drinking in chemotherapy area is highly harmful; but a significant number of respondents kept foods in proximity to the preparation room and had in the same area. Adverse effects are causing because of exposure to chemotherapy agents, organizations include National Institute of Occupational safety and Health administration (NIOSH), Oncology Nursing Society, American Society of Hospital Pharmacist (ASHP), American Society of Clinical Oncology (ASCO) and Occupational Safety and Health Administration (OSHA) have recommended safety guidelines for handling of chemotherapy agents.^{27,32,33} It has been advised to adhere to all safety guidelines to all workers who work with chemotherapy drugs (NIOSH, 2004). This research has shown that physical contact with chemotherapy agents was significantly associated with training ($p=0.017$). This study has demonstrated that about half of respondents already been exposed directly with sterile chemotherapy agents while working in chemotherapy unit.

CONCLUSION

This study found that most nurses have an average knowledge for handling chemotherapy agents; however, continuous education and update knowledge need for both using safety measures and follow its guideline in every step of the work. Study finds accentuates the necessity for adequate facilities for preparation and use of personal protective equipment to prevent direct exposure with chemotherapy agents. Furthermore, in-service training is an effective tool for safe handling practice of chemotherapy agents and its wastes. Regular medical surveillance is an indispensable step for both physical and mental health of the healthcare providers. Maintaining standard procedures and proper equipments in chemotherapy unit is essential for ensuring safe medication and personal protection as well as to prevent environmental contamination.

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