Knowledge and Attitude on Safe Handling of Cytotoxic Agents among Healthcare Staff in Tengku Ampuan Rahimah Hospital (HTAR), Klang

Lee Jian Lynn[1], Tai Chu Hong[1], Lim Soon Seng[1], Keng Zhi Hong[1], Nur Syuhada Zainudin[1], Yeo Wei Yan[1], Lee Sheah Lin[1], Khairul Azrul Abdul Rahman[1]

[1] Tengku Ampuan Rahimah Hospital, Ministry of Health Malaysia

Abstract

Introduction: Cytotoxic agents are known to be teratogenic and mutagenic. Inappropriate handling of these agents can lead to occupational hazards among the healthcare staff especially nurses who are mainly involved in the handling of cytotoxic agents.
Objective: To assess the nurses' knowledge and attitude on the safe handling of cytotoxic agents and to identify possible factors that influence the knowledge of safe handling of cytotoxic agents in HTAR, Klang.
Methods: A cross-sectional survey using a validated self-administered questionnaire was carried out. The questionnaires were distributed to all the 106 staff nurses from six wards that handle cytotoxic agents in HTAR. Ethics approval was obtained prior to the commencement of data collection.
Results: Data collected from 96 staff nurses were included in the analysis. The mean age of the nurses was 27.75 (SD 4.37) years old. The duration of nursing and cytotoxic drug handling experience were 4.21 (SD 3.77) and 2.76 (SD 2.24) years respectively. The mean knowledge score on safe handling of cytotoxic agents was 58.46 (SD 12.88). Cytotoxic drug handling in most nurses were taught by senior staff (85.4%) and only 6.3% of nurses received formal post-registration education on chemotherapy. Our study found no significant correlation between the duration of nursing experience (r=0.081, p=0.433) and cytotoxic drug handling experience (r=0.057, p=0.581) with the knowledge score.
Conclusion: The knowledge and attitude on cytotoxic drug handling among the nurses in HTAR were just slightly above average. Only a handful of the nurses received formal post-registration education on chemotherapy. The knowledge on cytotoxic safe handling was not correlated with the duration of nursing and cytotoxic drug handling experience. Continuous education and structured trainings are required to improve the knowledge and awareness on the safe handling of cytotoxic agents.

Keywords: cytotoxic agents, nurses, occupational exposure

NMRR ID: NMRR-17-2553-37801

Corresponding author:
Lee Jian Lynn
Pharmacy Department
Tengku Ampuan Rahimah Hospital,
Jalan Langat,
41200 Klang,
Selangor
Email: jianlynn83@yahoo.com

Introduction

The term cytotoxic is used to describe any agent that may be hazardous to the cells in any way. Cytotoxic agents are primarily intended for the treatment of cancer[1]. In 2012, worldwide statistics showed that there were a total of 32.6 million people living with cancer with 14.1 million of new cases and 8.2 million cancer deaths (within 5 years of diagnosis)[2]. In Malaysia, the incidence of newly diagnosed cancer was 37,426 cases in 2012[2].

In Tengku Ampuan Rahimah Hospital (HTAR), intravenous cytotoxic drugs is administered in the Chemotherapy Day Care Unit, Obstetrics And Gynaecology, Surgical (2 wards), Haematology and Nephrology wards. Common indications include blood cancer, solid cancer, nephrology (lupus nephritis), rheumatology (systemic lupus erythematosus and rheumatoid arthritis) and ectopic pregnancy. Injectable cytotoxic drugs are prepared by the Pharmacy Department's Cytotoxic Drug Reconstitution (CDR) Unit in the cytotoxic clean room and then supplied to the respective wards in the hospital. Oral cytotoxic drugs are kept in CDR Unit and outpatient pharmacy and directly dispensed to the patients.

With the rise in the number of cancer patients, the usage of cytotoxic agents increases as well. In the inpatient care settings, nurses are one of the main groups of healthcare professionals that are exposed to these drugs as they are the ones who handle and administer the products to the patients. Exposed nurses risk the same adverse effects as patients with no therapeutic benefits. Possible chronic effects include cancer, fertility problems, long term genetic changes in off springs, abortion and abnormalities in the fetus[3]. Therefore, the knowledge, awareness and adherence of nurses regarding the safe handling of cytotoxic agents are essential to minimise occupational exposure.

To date, several studies have been conducted to assess the attitude and knowledge of safe handling of cytotoxic agents among nurses[4-7]. HTAR being one of the state hospitals, and the second busiest hospital in Malaysia, was lacking such data. Hence, this cross-sectional survey study is important to determine the attitude and knowledge in safe handling of cytotoxic agents among the nurses in this hospital and could serve as a benchmark for future interventions. The objectives of this study were 1) to assess the current knowledge and attitude in the safe handling of cytotoxic agents among the nurses, and 2) to identify possible factors that influence the knowledge of safe handling of cytotoxic agents in HTAR.

Methods

The questionnaire was adapted from a previously validated survey developed by Keat *et al.*[5]. The self-administered questionnaires were distributed to all staff nurses in the six wards that handle cytotoxic agents in HTAR during the study period from December 2017 to January 2018. The completed questionnaires were then returned to the study team.

All staff nurses who were involved in any stage of cytotoxic agent handling such as collection, transportation, reconstitution, dilution, dispensing and administration to patients, storage, disposal, and spillage management of cytotoxic agents during the study period were included. This research was approved by the Medical Research and Ethical Committee (MREC) and was granted with National Medical Research Registry (NMRR) identity number of NMRR-17-2553-37801.

Both descriptive and analytical statistics were used. Nurse characteristics such as gender and marriage were presented in frequency (n) and percentage (%). Continuous data such as age, nursing experience and cytotoxic drug handling experience were expressed as mean and standard deviation (SD). All data were tabulated in table forms. Spearman correlation test was used to evaluate the association between the mean knowledge score and possible factors which may influence the score, which are nursing experience and cytotoxic drug handling experience. A *p*-value less than 0.05 was considered as statistically significant. Data were analysed using the Statistical Package for Social Sciences (SPSS) version 23.0.

Results

A total of 106 staff nurses from six different wards that handles cytotoxic agents participated in the survey. However, only 96 survey forms were analysed as ten were excluded due to incomplete forms. The demographic characteristics of respondents were shown in Table 1. The mean age of the nurses was 27.75 (SD 3.47) years old. Years of nursing experience and cytotoxic drug handling experience were 4.21 (SD 3.77) and 2.76 (SD 2.24) years respectively.

The findings of nurses' knowledge were as tabulated in Table 2. The mean knowledge score on safe handling of cytotoxic agents was 58.46 (SD 12.88). The data was then further analysed according to the wards of the respondents (Table 3). Among all the wards involved in this study, Chemotherapy Day Care Unit, with only three staff nurses, scored the highest. Figure 1 showed the chemotherapy training methods that the nurses received. Cytotoxic drug handling in the majority of nurses were taught by senior staff (85.4%) and the percentage of nurses who received formal post-registration education on chemotherapy was only 6.3%.

Figure 2 showed the attitude of nurses towards safety related issues of cytotoxic drug handling. Most of the nurses (60.4%) felt confident to handle cytotoxic drugs safely. Some of them (28.1%) believed that complete personal protective equipment (PPE) usage were unnecessary, while some of the nurses (30.2%) were worried about long-term side effects of occupational exposure. Only a small percentage (7.3%) of nurses were able to tolerate a certain level of improper practice when they are busy, but around quarter of them (28.1%) were able to tolerate a certain level of improper practice among their peers. Further analysis with Spearman correlation showed that there was no significant correlation between the duration of nursing experience ($r=0.081$, $p=0.433$) and cytotoxic drug handling experience ($r=0.057$, $p=0.581$) with the nurses' knowledge scores on cytotoxic safe handling.

Table 1: Demographics of respondents in HTAR (N = 96)

Characteristics	n (%) / mean (SD)
Gender, n (%)	
Male	3 (3.1)
Female	93 (96.9)
Age, mean (SD)	27.75 (3.47)
Marital status, n (%)	
Married	60 (62.5)
Unmarried	36 (37.5)
Nursing experience, mean (SD)	4.21 (3.77)
Cytotoxic drug handling experience, mean (SD)	2.76 (2.24)

Table 2: Mean scores of staff nurses' knowledge on general and four important areas of cytotoxic drug handling (N = 96)

Topic of concern	Score, mean (SD)	Total score
Hazardous effect	13.82 (4.28)	25
Chemotherapy exposure	9.58 (3.26)	15
Use of PPE	7.84 (2.45)	15
Safe handling measures	27.21 (7.43)	45
Overall	58.46 (12.88)	100

Table 3: Mean scores of staff nurses' knowledge on cytotoxic drug handling according to ward

Ward	Score, mean (SD)	Number of respondents
Chemotherapy Day care	75.83 (5.2)	3
Haematology	65.63 (6.65)	24
Surgical 1	61.2 (6.46)	29
Obstetrics & Gynaecology	59.0 (9.34)	15
Surgical 2	54.33 (12.48)	15
Nephrology	33.5 (11.97)	10
Total	58.46 (12.88)	96

Figure 1: Methods of learning cytotoxic drug handling

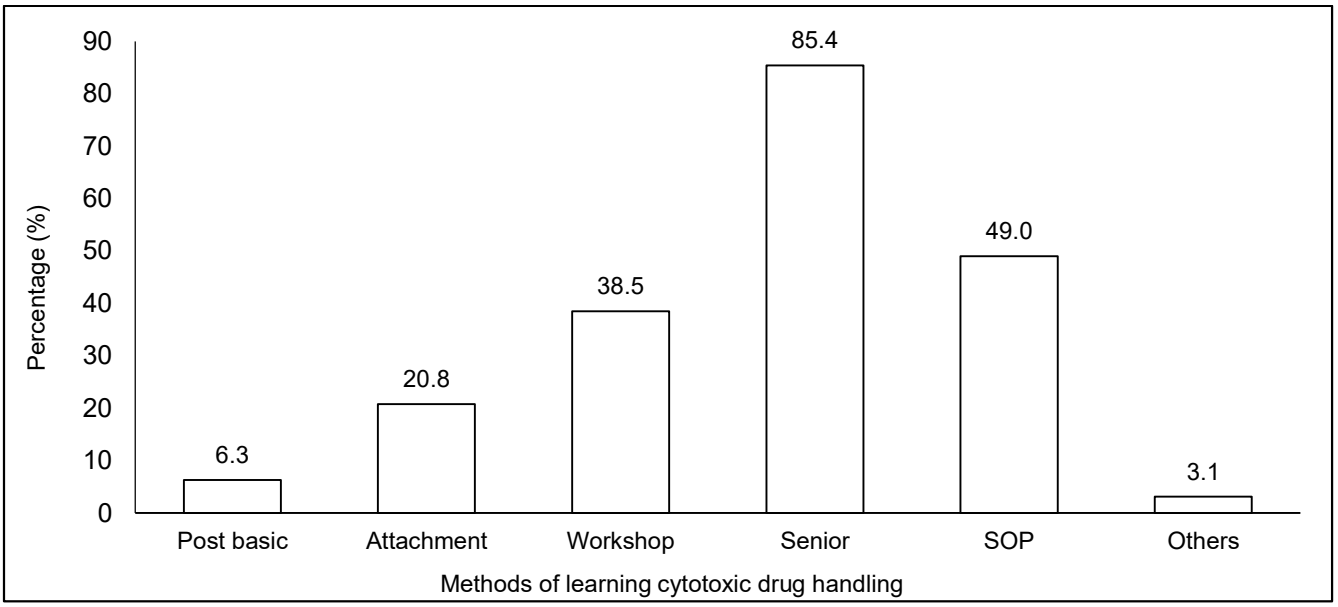
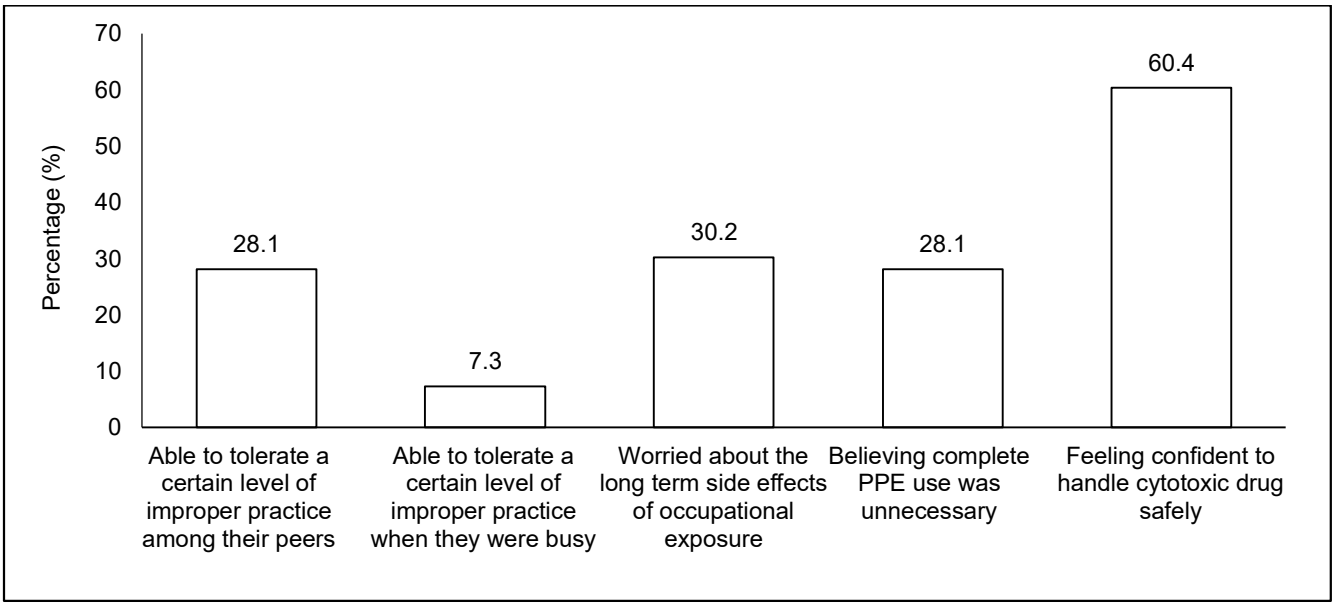


Figure 2: Staff nurses' attitude towards safety related issues of cytotoxic drug handling



Discussion

The mean score of nurses' knowledge on cytotoxic drug handling (58.46 out of 100) was comparable to the pre-intervention score of a local study done in Sultanah Bahiyah Hospital, Kedah (45.4 out of 100)[5]. It was also comparable to the achievement of Turkish nurses (61.32%), but lower than the Cypriot (79.4%) in similar studies that assessed the nurses' knowledge on cytotoxic drug handling[6-7].

This study found that cytotoxic drug handling of the majority of nurses were taught by senior staff (85.4%) and this method posed a risk of poor practice and knowledge to be passed on to future colleagues. Comparing with the other regions in the world, the percentage of nurses who handle chemotherapy in this hospital receiving formal post-registration education on chemotherapy is very low (6.3%). Studies in the UK hospitals showed 96% of the nurses who handles chemotherapy had formal post-registration training on chemotherapy, while hospitals in Pakistan and Cyprus had 37% and 18.2% respectively[7-9]. High knowledge level among the nurses is important to improve their adherence to the safety measures[6].

The results of this study also showed that some nurses may not have the right attitude towards safe handling guidelines of cytotoxic agents and were placing themselves and the others at the risk of cytotoxic exposure. These results were in line with findings of previous studies whereby nurses were not sufficiently trained to care for cancer patients and had poor understanding on safety-related issues of chemotherapy[10-11]. Therefore, more structured hands-on training and workshops on safe handling of cytotoxic agents should be conducted to build up the confidence and to raise awareness among the healthcare staff. Occupational Safety and Health Administration (OSHA) should play an active role in addressing this issue to protect health workers.

As there was no significant correlation between the knowledge score on cytotoxic drug handling and the duration of nursing and cytotoxic drug handling experience , all staff handling cytotoxic drug must receive education and training on safe handling procedures prior to working with cytotoxic drugs. Continuous education and trainings are equally important. Written standard operating procedure (SOP) should be assessable to all relevant staff and should be updated in accordance with the latest guideline. Their safe handling competency and compliance should also be assessed on a regular basis. In addition, an open and effective knowledge-sharing environment among the healthcare staff should be promoted to empower them to make more informed safety and health decisions.

The main limitation of this study was its small sample size. The findings may not be generalised to other settings as there are relatively small number of nurses working in wards that handle chemotherapy in this hospital. Nevertheless, this is the first study carried out in HTAR to assess the knowledge and attitude of safe handling of cytotoxic agents and these preliminary findings could serve as a benchmark for future interventions. It was a general survey of the knowledge and attitude of the nurses and may not reflect the actual practice in the ward. As the nurses' adherence to cytotoxic handling guidelines were not measured in this study, clinical audit on practice can be done in future.

Conclusion

This study showed that the knowledge and attitude on cytotoxic drug handling among the nurses in HTAR were just slightly above average. Majority of the nurses learned about cytotoxic drug handling from their seniors and only a handful of them received formal post-registration education on chemotherapy. The knowledge on cytotoxic safe handling was not correlated with the duration of nursing and cytotoxic drug handling experience. Continuous education and structured trainings are required to improve the knowledge and awareness on the appropriate handling of cytotoxic agents.

Acknowledgement
We are deeply indebted to our supervisors whose motivation and guidance helped us to complete this work. We would like to extend a special thanks to pharmacist Chan Huan Keat for allowing to use the survey questionnaires used in his previous research at Sultanah Bahiyah Hospital, Alor Setar. We would like to thank the Director General of Health Malaysia for his permission to publish this article. Finally, thanks to all who contributed towards this work.

Conflict of Interest Statement
No external funding was received and the authors declared no conflict of interest.

References

1. Somayeh Hanafi; Hassan Torkamandi; Sahar Bagheri; Maria Tavakoli; Naser Hadav; Javadi, M., Safe Handling of Cytotoxic Drugs and Risks of Occupational Exposure to Nursing Staffs. *Journal of Pharmaceutical Care* **2015,** *3* (1-2), 11-15.
2. GLOBOCAN 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012. http://globocan.iarc.fr/Default.aspx.
3. Elshamy K, E.-H. M., El-Roby M, Fouda M, Health hazards among oncology nurses exposed to chemotherapy drugs. *African Journal of Haematology and Oncology* **2010,** *1* (3), 70-78.
4. Polovich, M.; Martin, S., Nurses' use of hazardous drug-handling precautions and awareness of national safety guidelines. *Oncology nursing forum* **2011,** *38* (6), 718-26.
5. Keat, C. H.; Sooaid, N. S.; Yun, C. Y.; Sriraman, M., Improving safety-related knowledge, attitude and practices of nurses handling cytotoxic anticancer drug: pharmacists' experience in a general hospital, Malaysia. *Asian Pacific journal of cancer prevention : APJCP* **2013,** *14* (1), 69-73.
6. Turk, M.; Davas, A.; Ciceklioglu, M.; Sacaklioglu, F.; Mercan, T., Knowledge, attitude and safe behaviour of nurses handling cytotoxic anticancer drugs in Ege University Hospital. *Asian Pacific journal of cancer prevention : APJCP* **2004,** *5* (2), 164-8.
7. Kyprianou, M.; Kapsou, M.; Raftopoulos, V.; Soteriades, E. S., Knowledge, attitudes and beliefs of Cypriot nurses on the handling of antineoplastic agents. *European journal of oncology nursing : the official journal of European Oncology Nursing Society* **2010,** *14* (4), 278-82.
8. Verity, R.; Wiseman, T.; Ream, E.; Teasdale, E.; Richardson, A., Exploring the work of nurses who administer chemotherapy. *European journal of oncology nursing : the official journal of European Oncology Nursing Society* **2008,** *12* (3), 244-52.
9. Khan, N.; Khowaja, K. Z. A.; Ali, T. S., Assessment of knowledge, skill and attitude of oncology nurses in chemotherapy administration in tertiary hospital Pakistan. *Open Journal of Nursing* **2012,** *Vol.02No.02*, 4.
10. Polovich, M., Nurses' Use of Hazardous Drug Safe Handling Precautions. Georgia State University: 2010.
11. Corner, J.; Wilson-Barnett, J., The newly registered nurse and the cancer patient: An educational evaluation. *International Journal of Nursing Studies* **1992,** *29* (2), 177-190.