RESEARCH ARTICLE

Impact of awareness and knowledge about different types of drug-related interactions among nurses in a tertiary health center

Shreya Joshi[1], Rangeel Singh Raina[2], Atul Kumar Singh[3]

[1]MBBS Student, Government Doon Medical College Dehradun, Uttarakhand, India, [2]Department of Pharmacology, Government Doon Medical College Dehradun, Uttarakhand, India, [3]Department of Anesthesia, Government Doon Medical College Dehradun, Uttarakhand, India

Correspondence to: Rangeel Singh Raina, E-mail: rainarangeel@gmail.com

ABSTRACT

Background: Drug interaction is a condition in which one drug influences the action of other drugs. The level of knowledge of nurses about drug-food interactions has a significant role in the avoidance of adverse drug reactions. **Aim and Objective:** This study aims to study the knowledge among nurses about drug-related interactions and to evaluate the impact of its awareness among nursing staff. **Materials and Methods:** A cross-sectional observational study about improvement in knowledge and awareness of drug-related interactions among nursing staffs of different departments in Government Doon Medical College, Dehradun, after an awareness training program was conducted using a modified validated, structure questionnaire. **Results:** Out of the four departments, nurses of surgery department had the best knowledge about drug-related interactions than other departments. Significant improvement was observed in the knowledge of nurses of operation theater and medicine department after educational training, whereas no significant improvement was observed in the nurses of surgery department about drug-related interactions. There was a positive correlation between knowledge and experience as nurses having a median experience of 10.87 years post-registration had better knowledge. **Conclusion:** To improve the patient safety, the knowledge of nurses about different types of drug-related interactions is highly essential.

KEY WORDS: Drug Interaction; Adverse Drug Reaction; Medication Error, Food-Drug Interaction

INTRODUCTION

Patient safety is a grave universal public health issue. Medicines are usually used to treat patients and cure many health problems. However, medicines should be taken properly to ensure that these are safe and effective. Diet and lifestyle can sometimes have a significant impact on drugs response. A drug interaction can be defined as a situation in which a substance influences the activity of drug and as a result the effects of drug might be increased or decreased or produce a fresh response that neither generates on its own. In the United States, it has been observed that 7% of drug side effects were responsible for drug interactions.[1] Drug interactions have immense economy burden also.

Different types of drug interaction occur when one drug was ingested with other drug or food items. This type of interaction might lead to changes in the kinetics, dynamics, and therapeutic effectiveness of the drug. It is usually more common in polypharmacy for chronic cases which is more prevalent in the aged patients and such group of patients should be closely monitored frequently for food and drug interactions.[2] Drug interaction does not stands for only drug-drug interactions, but here we should also considerate about food-drug interaction also. Hence, for the safety of patients

and the prevention of drug interactions, it is essential to have awareness about all expected drug interactions.[3]

Foods have very significant role in drug bioavailability. Gastric emptying timing and activity of drug metabolizing enzymes can be modified by the presence and timing of food which may lead to treatment failure.[4] Similarly, physiologic mechanisms such as stimulated bile or splanchnic blood flow and pH or flora changes of gastrointestinal system can reduce the absorption of drugs.[5]

Vitamin K in dietary sources, such as spinach or broccoli, has been found to be antagonist to warfarin, so dosage of warfarin is need to be increased then therapeutic dose. Similarly, bioflavonoid found in grapefruit juice is cytochrome P450 inhibitor, so grape juice might inhibit the metabolism of many drugs.[6,7] This type of drug interactions might increase the level of drugs in the body and, especially in case of drugs with low therapeutic index, there is very high probability of significant harmful effects.[8]

Nurses have a vital role in detection of medical errors. Nurses assess the patients very closely and have important role in proper use of their medication. The knowledge and clinical reasoning of nurses are very crucial to administer medication safely to the patients.[9]

The Institute of Medicine report, "Keeping Patients Safe," accepted that nursing profession has decisive role in patient safety.[10,11] The prevalence of potential inappropriate drug prescription was observed high in western nursing homes and the study has emphasized that there is immense requirement of the new studies to evaluate the strategies to minimize the burden and maximize the safety of the patients.[12]

Even though fresh nurses have a good academic knowledge about nursing skills, there is no doubt that experienced nurses usually serve a better and safer level of practice. However, a continuous learning is must for the experienced nurses for better performance.[13] Medication errors might be associated with adverse drug reactions (ADRs). Therefore, nurses should be well aware and updated about drugs and nutritional status of the patients which may prevent the occurrence of ADRs related to drug interactions. About 2.8% of hospital admissions were mainly due to drug interactions,[14] whereas severe drug interactions were reported in 1.5–28% of hospitalized elderly patients.[15] Several studies confirmed that nurses have vital role in patient safety.[16]

Nurses should be very vigilant in scrutinizing possible drug interactions and should guide the patients that which food and beverages should be to avoided with certain drugs. It is crucial that nurses should be well updated about potential drug interactions for the patient safety. Continuing education has the vital role in updating of the nurses about contemporary development and progression in nursing, technology, and

medical sciences along with recent patient care trends and research.[10]

For the prevention of food-drug interactions (FDIs), nurses require enough knowledge about foods and drug interaction. This knowledge-based information come from the nurse's previous experience and understanding. The nurses always have vital role for the education of the patient regarding foods interaction with certain drugs along with details of the signs and symptoms due to adverse reactions from such interactions. Therefore, the nurses must have a sufficient knowledge of drug-related interactions for the safety of the patients. Continuous education actually improves the knowledge and ability of the nurse's regarding drug-related interactions and it would definitely improve the patient safety.[17]

Despite the sensitivity of the issue, it has been observed that there are gaps in data depicting nurses' evidence-based practice. Very limited literature is there to evaluate the nurses' understanding of pharmacology of different types of drug interactions and its prevention. To accentuate the significance of this issue, appropriate evidence should be generated to establish protocols and it would be helpful to the health workers to imbibe the evidence-based practices in daily practices.

Hence, to improve the safety of patient, better efficacy, improved drug therapy, and reducing ADRs, this study aims to investigate the knowledge of nurses about pharmacology with respect to different types of drug interactions and impact of training about drug interaction.

MATERIALS AND METHODS

This was a cross-sectional observational study to evaluate the knowledge and awareness of drug related interactions among nursing staff of Government Doon Medical College, Dehradun. The study was conducted from April 2018 to August 2018, using the modified validated, structured questionnaire of Jyoti *et al.*[18] The questionnaire mainly focused on common drug-related interactions. This study was conducted in 30 nursing staffs of Government Doon Medical College, Dehradun. Nursing staffs were divided into four different groups (nurses deputed in medicine, surgery, OT and others). Ethical approval has been taken from the Institutional Ethics Committee of Government Doon Medical College, Dehradun (IEC Letter No: GDMC/IEC/007 dated 21-8- 2018). Informed consent was collected from all the participants before distribution of the questionnaire.

The structured questionnaire for this study was prepared in two parts. The first part has demographic data such as age, sex, and education level. The second part has 25 multiple-choice questions associated to the nurses knowledge about

drug-related interactions. The study was performed as follows:

- Step 1: The structured questionnaire was used to find out the knowledge among nursing staffs about drug-related interactions
- Step 2: All participants were educated about different drug-related interactions
- Step 3: The same structured questionnaire was then used to find out the improvement in knowledge and attitude among nursing staffs about drug interactions before and after awareness and educational training.

Statistical Analysis

Statistical analysis was concluded using the Statistical Package for the Social Sciences statistics (SPSS) Version 22. Results were expressed as mean±SD for continuous variables. Questions scored correct will be given one point while incorrect answers will be given a 0 point. Association between variables was done using Pearson's Chi-square test. The level of significance was set at $P < 0.05$.

RESULTS

The survey was completed within 4 months of the start of the study. All 30 nurses having median age of 44.96 years, had responded, and most of the participants completed the questionnaire within 30 min [Table 1].

When we evaluated the changes in score value among nurses of different departments, it has been observed that nurses of operation theatre department showed the best improvement in score ($P < 0.05$) followed by nurses of medicine department [Figure 1].

On the assessment about the correlation of experience of nurses and improvement in performance, it was found that nurses with experience of 0–10 years demonstrated the best improvement in score than the nurses with more experience. This correlates with the fact that newly appointed nurses have relatively better ability to grasp the concept and knowledge imparted to them [Figure 2].

It has been detected in the study that nurses of 20–30 years of age have significant improvement in score followed by nurses of 40–50 years and 30–40 years of age, whereas nurses of 50–60 years age showed little improvement [Figure 3].

In the pre-test, most of nurses (29 out of 30) answered wrongly regarding interaction of intravenous administration of gentamicin with other drugs in same syringe, whereas all nurses scored right answer about interaction of metronidazole with different beverages. Question based on drugs to be avoided in gout patients was marked wrongly by 25 nurses, whereas 24 nurses could not answer the

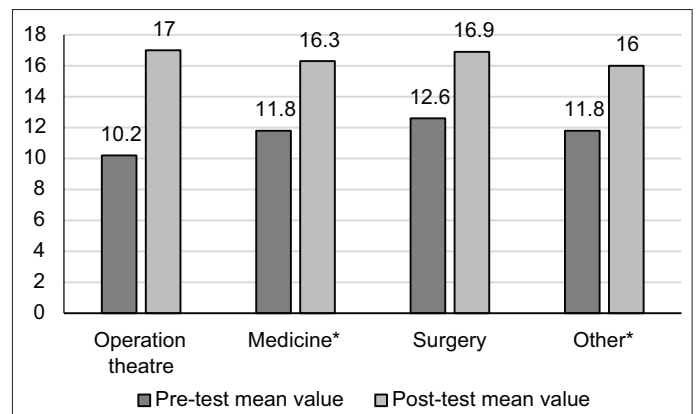| Table 1: Demographic data		
Age distribution		
Number	**Mean age**	**Std. deviation**
30	44.96	
Nursing experience		
Range	**Frequency**	**Percentage**
Up to 5 years	2	6.7
6–10 years	3	10
11–15 years	9	30
16–20 years	13	43.3
>21 years	3	10

Figure 1: Comparative difference in mean score value among nurses of different departments (*statistically significant difference)

Figure 2: Relationship between nursing experience and improvement in performance (*statistically significant difference)

interaction of drugs with metronidazole which might lead to bleeding [Figure 4].

In the post-test, that is, after the training program, on question about absorption of different drugs with fatty meal was wrongly answered by 22 out of 30 nurses. Of the nine questions related to drug-food interactions, nurses of surgery department performed the best while nurses of medicine and others department performed poorly. Twenty-one nurses could not mark the correct answer related to interaction of drug with vegetables. Whereas in post-test, all participants

Figure 3: Relationship between age of nursing staffs and improvement in performance
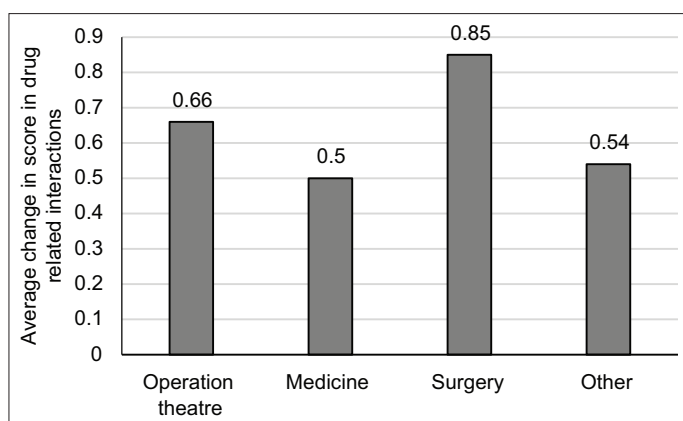

Figure 4: Average changes in score of nurses deputed in different departments

answered correctly about drug interactions with different fruits and interaction affecting digoxin absorption.

DISCUSSION

Drug-related interactions are becoming grave issue with complex drug treatments. It can lead in anything from minor morbidities up to fatal outcomes. The incidence of the interaction in one of the studies was 58.27%.[18]

This study was conducted to assess the impact of knowledge and awareness of drug-related interactions among nurses with varying levels of experience and ages. The main intention of this study was to evaluate whether continuous learning will reduce the medication errors related to drug-food interaction. It has been observed that by improving the knowledge of the nurses about different types of drug interactions, awareness among nurses about common harmful interactions has been enhanced and the chances of medication error can be minimized. Further, with the help of regular vigilance and awareness program, nurses are able to avoid mistakes or minimize injury to the patient.

Our study is in agreement with the previous studies[19] that have shown that there is lack of knowledge among health-care

professionals about FDI. Out of the four departments, nurses of surgery department had the best pre-score related to drug interactions.

The observations of this study did not demonstrate that nurses having more experience scored better than nurses with less years of experience in drug-related interaction. This is in favor of the results of one research that has observed that tactic knowledge was more in experienced nurses than theoretical one.[20] This study supports the policy of preserving experienced nurses for a longer period through educating them continuously. Hence, it becomes mandatory that nurses should be regularly updated about drug-related reactions to ensure patient safety. Nurses having the experience of more than 20 years scored higher than other groups.[10] Poor communication between health-care providers can lead to polypharmacy.[21]

The nurses clinical experience may be an important factor to minimize any type of medication error.[22] In addition, as nurses experience grows up, they are more able to interpret a situation and intercept medication errors. Studies linking nurse's clinical experience and medication errors are inconclusive. Some have shown that in experienced nurses are correlated to increased risk for medication errors.[23] Studies in office workers have pointed out that experienced workers more often make rule-based errors, while novice makes more knowledge-based errors.[24]

Gender may have importance when discussing how we are affected by weaknesses of the system and clinical performance. A Canadian study exploring unsafe patient care events by nursing students reported that a higher number of unsafe events were observed with male nursing students.[25] It is well known that males are more prone to risk-taking in various contexts.[26]

The best improvement was seen in knowledge of the nurses deputed in operation theater ($P < 0.05$). They had a median experience of 10.87 years post-registration. Hence, there was a correlation between knowledge and experience.

Drug interaction can also occur between drugs. It may be observed with food (grapefruit juice, garlic, and broccoli), any kind of foreign substance (xenobiotica), as well as caffeine beverages and alcohol. Of the nine questions related to drug-food interactions, nurses of surgery department performed the best while nurses of medicine and other departments performed poorly in post-test. Twenty-one nurses could not mark the correct answer related to interaction of drug with vegetables. Whereas in post-test, all participants answered correctly about drug interactions with different fruits and interaction affecting digoxin absorption.

The routine awareness and education of the nurses had a great impact on decreasing the medication errors. The study

has proved it that patient safety outcomes can be improved by the regular and appropriate training of the nursing staffs.

The study contributes to the limited literature available about nurse's knowledge of FDIs and allows for future research work. Furthermore, finding of the study would be helpful for the educational purpose and health-care policy-makers. The results would definitely improve the knowledge of important FDIs among nurses.

The limitation of this study is small sample size and short duration of study. The study can be further extended for the evaluation of knowledge of nurses after 6–12 months.

CONCLUSION

To improve the safety of patient, decrease in morbidity and mortality, it is very imperative that the knowledge of nurses about different types of drug interactions is highly essential. Therefore, to improve awareness, we need frequent awareness and regular efforts about potential food-drug interactions among nursing staffs.

REFERENCES

1. Phillips J, Beam S, Brinker A, Holquist C, Honig P, Lee LY, *et al*. Retrospective analysis of mortalities associated with medication errors. Am J Health Syst Pharm 2001;58:1835-41.
2. Mouly S, Morgand M, Lopes A, Lloret-Linares C, Bergmann JF. Drug-food interactions in internal medicine: What physicians should know? Rev Med Interne 2015;36:530-9.
3. Lasswell AB, Deforge BR, Sobal J, Muncie HL Jr., Michocki R. Family medicine residents' knowledge and attitudes about drug-nutrient interactions. J Am Coll Nutr 1995;14:137-43.
4. Kersemaekers WM, Dogterom P, Xu J, Marcantonio EE, de Greef R, Waskin H, *et al*. Effect of a high-fat meal on the pharmacokinetics of 300-milligram posaconazole in a solid oral tablet formulation. Antimicrob Agents Chemother 2015;59:3385-9.
5. Singh BN. Effects of food on clinical pharmacokinetics. Clin Pharmacokinet 1999;37:213-55.
6. Andrade C. Fruit juice, organic anion transporting polypeptides, and drug interactions in psychiatry. J Clin Psychiatry 2014;75:1323-5.
7. Hanley MJ, Cancalon P, Widmer, WW, Greenblatt D. The effect of grapefruit juice on drug disposition. Expert Opin Drug Metab Toxicol 2011;7:267-86.
8. Mason P. Important drug-nutrient interactions. Proc Nutr Soc 2010;69:551-7.
9. Gaffney TA, Hatcher BJ, Milligan R. Nurses role in medical error recovery: An integrative review. J Clin Nurs 2016;25:906-17.
10. Enwerem NM, Okunji P. Knowledge, attitudes and awareness of food and drug interactions among nurses with different levels of experience. Int J Nurs 2015;2:1-9.
11. Institute of Medicine. Committee on the Work Environment for Nurses, Patient Safety. Keeping Patients Safe: Transforming the Work Environment of Nurses. Washington DC: National Academy Press; 2004.
12. Ruggiero C, Lattanzio F, Dell'Aquila G, Cherubini A. Inappropriate drug prescriptions among older nursing home residents: The Italian perspective. Drugs Aging 2009;26 Suppl 1:15-30.
13. Hill K. Improving quality and patient safety by retaining nursing expertise. Online J Issues Nurs 2010;15:1.
14. Jankel CA, Fitterman LK. Epidemiology of drug-drug interactions as a cause of hospital admissions. Drug Saf 1993;9:51-9.
15. Kashyap M, D'Cruz S, Sachdev S, Tiwari P. Drug-drug interactions and their predictors: Results from Indian elderly inpatients. Pharm Pract (Granada) 2013;11:191-5.
16. IOM Recommendations. The Future of Nursing Leading Change, Advancing Health Advising the Nation/Improving Health; 2010. Available from: https://www.iom.edu/nursing. [Last accessed on 2015 Mar 20].
17. Enwerem NM, Okunji P, Johnson A. Editorial: Food-drug interactions: Implications for nursing practice. Nurs Health Care Int J 2017;1:102.
18. Chavda NB, Solanky PP, Baria H, Naik R, Bharti K. Study of potential drug-drug interaction between prescribed drugs in patients attending outpatient department of medicine at tertiary-care hospital in South Gujarat region. Natl J Physiol Pharm Pharmacol 2015;5:236-42.
19. Jyoti MB, Jayanthi MK, Basavaraj RT, Renuka M. Knowledge and Awareness of food and drug interactions (FDI): A survey among health care professionals. Int J Pharmacol Clin Sci 2012;1:97-105.
20. Evans RJ, Donnelly GW. A model to describe the relationship between knowledge, skill, and judgment in nursing practice. Nurs Forum 2006;41:150-7.
21. Rahmawati F, Pramantara ID, Romah W, Sulaiman SA. Polypharmacy and unnecessary drug therapy on geriatric hospitalized patients in Yogyakarta Hospital, Indonesia. Int J Pharm Pharm Sci 2009;1:6-11.
22. Chang YK, Mark BA. Antecedents of severe and nonsevere medication errors. J Nurs Scholarsh 2009;41:70-8.
23. Blegen MA, Vaughn TE, Goode CJ. Nurse experience and education: Effect on quality of care. J Nurs Adm 2001;31:33-9.
24. Zapf D, Brodbeck FC, Frese M, Peters H, Prumper J. Errors in working with office computers: A first validation of a taxonomy for observed errors in a field setting. Int J Hum Comput Interact 1992;4:311-39.
25. Gregory D, Guse L, Dick DD, Davis P, Russel CK. What clinical learning contracts reveal about nursing education and patient safety. Can Nurse 2009;105:20-5.
26. Ayanian JZ, Epstein AM. Attitudes about treatment of coronary heart disease among women and men presenting for exercise testing. J Gen Intern Med 1997;12:311-4.