KNOWLEDGE AND PRACTICES OF NURSES WORKING IN INTENSIVE CARE ON DRUG-DRUG INTERACTION

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ABSTRACT

Purpose: *This study was conducted to examine the knowledge and practices of nurses working in the intensive care unit about drug-drug interaction.*

Subject and Methods: *This study was conducted with 186 intensive care nurses working in shifts in 12 intensive care units from Malatya in Turkey. "Nurse information form", "Drug-drug interaction questionnaire" prepared by the researcher, and "nurse observation form" were used in data collection. The data obtained from the study were evaluated using frequency, percentage distribution, and Chi-square test.*

Results: *In the study, the majority of the nurses working in the intensive care unit reported that they did not know which of the drug pairs they encountered frequently caused drug-drug interactions. When the drugs administered by the nurses were examined, it was determined that 34.4% of them had the potential for drug-drug interaction. It was found that nurses' potential drug-drug interaction practices, staff status and working styles, and working time in the institution, profession and intensive care unit were not effective. It was determined that there were significant differences between the intensive care units (p=0.043) in the drug-drug interaction practices encountered.*

Conclusion: *It was determined that the nurses did not have the desired level of knowledge about drug-drug interactions and interacting drug pairs, and there were differences between the intensive care units where they worked. It is recommended to increase the level of knowledge by giving regular training to nurses on drug-drug interaction.*

INTRODUCTION

Intensive care units (ICU) are specialized units where the follow-up and treatment of critically ill patients are continued (Varon, 2016; Neuraz et. al., 2015). ICU nurses working in these units perform more drug administrations and interventions due to the complexity of the patients (Cheragi et. al., 2013; Di Muzio et al., 2016; Moyen et. al., 2008). In the ICU where drug administrations are high, it is inevitable to perform incorrect drug administration due to the high workload of nurses, the severity of the patient's condition (Cheragi et al., 2013; Di Muzio et al., 2016; Moyen et al., 2008). A study conducted in Spain (2013) revealed that one or more drug administration errors occurred in 58% of 1017 patients treated in the ICU (Merino et al., 2013).

Many factors are effective in the frequent occurrence of medication errors in the ICU, and drug-drug interactions occur as a result of multiple drug applications, which are among these factors (Bista et al., 2009). Patients in the ICU are administered more drugs than inpatients in other clinics, and this increases the risk of developing drug-drug interactions (Gülhan, 2013; Lima & Cassiani, 2009; Hammes et al., 2008). Drug-drug interactions (DDI) occur when more than one drug is administered together and can change the efficacy or toxicity of one or more drugs (Reddy, 2006). With the occurrence of DDI, it causes the absorption, distribution, metabolism or mechanism of action of the administered drug to be impaired on another drug (European Medicines Agency, 2010). This situation brings with it many factors such as decreased patient compliance and increased cost (Şimşek et al., 2019). In clinical studies, the interactions of drugs with a narrow therapeutic index are potentially life-threatening and in some cases cause the end of human life. (Harrington et al., 2011; Palleria et al., 2013; Fulton & Allen, 2005). According to the data reported by observational studies, the prevalence of potential drug interactions in the intensive care unit varies between 44.3% and 86% (Gülhan, 2013; Hammes et al., 2008; Magro et al., 2012). In a study on DDI in the ICU in Brazil (2016), it was determined that at least one drug interaction occurred in 70.6% of 1124 patients in a 24-hour period (Roque et al., 2016). In another study, it was reported that potential drug-drug interactions (PDDI) occurred in 101 patients out of 111 patients treated in the ICU, and the number of deaths in these patients was 66.7% (Aşcı et al., 2016). In a study examining the most common potential clinical outcomes of DDIs in the ICU, it was determined that it caused an increased risk of bleeding (12.3%), hyperkalemia (8.2%), arrhythmia (7.9%), and CNS depression (6.6%) (Oksuz et al., 2019).

Nurses in the ICU play a key role in the follow-up and treatment of patients, as they are in close contact with the patients receiving treatment (Akıcı & Kalaça, 2013). Nurses, who spend most of their time in drug administration, should be able to define the pharmacology principles of each drug, drug management, drug safety, drug preparation protocol, important parts of administration to patients, and possible drug-drug interactions so that patients are not exposed to undesirable situations, and they must have sufficient knowledge about drugs as well as the ability to administer drugs (Kiguba et al., 2015; Jones & Treiber, 2010; Uzun & Arslan, 2008). ICU nurses should regulate the patient's treatment hours and diet in a way to prevent drug-drug, drug-food interactions during drug administration (İyigün & Taştan, (2015; Kaya et al., 2018). Drug management and applications, which are under the responsibility of the nurse, are of great importance. In a study conducted on this issue, when the development status of possible drug-drug interactions was examined according to the drug administration hours planned by the nurses, it was found that 5.44% of 3066 drug doses made drug administration errors (Bueno et al., 2020). In their study, Elshenawi and Elazeem (2020) identified that nurses did not know the drug pairs that cause drug-drug interaction among drugs they frequently applied (Elshenawi & Elazeem, 2020). In their study on drug knowledge level, Aydın et al. (2017) found that 17.5% of nurses did not know that drug-drug interaction and drug-food interaction were among the drug error classifications (Aydın et al., 2017). In their study, Vural et al. (2014) found that 46.7% of the nurses' knowledge about drug interactions of the administered drugs was moderate and 11.4% had a bad degree (Vural et al., 2014). It was determined by the studies conducted in the field that nurses do not have sufficient knowledge about DDI and that there is a high need for education on DDI(Karahan et al., 2015).

Nurses constitute the closest group that provides health services to patients taking medication. The necessity of nurses to have sufficient knowledge about drugs in drug

administration also includes their level of knowledge about drug management and control. Therefore, recognizing drug-drug interactions has an important place in determining appropriate drug management strategies (Palma et al., 2020). In this context, our study aims to evaluate the knowledge levels and practice behaviors of nurses working in intensive care units about drug-drug interactions.

METHODOLOGY

Population and Sample of the Study

The study population consisted of 216 nurses working in shifts in 12 intensive care units within a research hospital. In the study, it was aimed to reach the entire population, not choosing a sample. However, since 30 of the nurses within the scope of the study refused to participate in the study and were on leave/report, 186 people were included in the study. The rate of participation in the research constituted 86.1% of the population.

Study Method

Research data were collected from nurses working in internal medicine, anesthesia, cardiology, cardiovascular surgery, burns, pediatrics, neurology, general surgery, neurosurgery, pediatric surgery, neonatal and organ transplant intensive care units in a research hospital between January 2016 and July 2018. The data were collected by using the face-to-face interview technique, which lasted approximately 15-20 minutes, with the nurses working in two shifts in the intensive care units with 8-hour and 16-hour shifts and the "Nurse Information Form", the "Drug-Drug Interaction Questionnaire" created by the researcher based on the literature, and the "Nurse Observation Form" used in the relevant intensive care unit, in which the drugs and application hours of the patients who participated in the research were followed and treated, were used. Nursing observation forms, medication follow-up forms, application time information and the names of the administered drugs were recorded one by one in a quiet, non-intervention-free area determined by the researcher within the unit, where the nurses participating in the study continued their follow-up and treatment. Regardless of the hospitalization process of the patients and the duration of their administration, all drug information and administration times were recorded. The active ingredients of the drug pairs that were registered and that the nurses had knowledge about drug-drug interactions were determined by accessing the prospectuses over the internet.

Data Collection Tools

Nurse Information Form

The form prepared by the researcher consisted of 10 questions containing information such as the participant's age, gender, education level, working time in the profession, working time in the institution where she/he worked, the type of working in the overtime and the staff status in the institution.

Drug-Drug Interaction Questionnaire Form

The form prepared by the researchers in line with the literature (Karahan et al., 2015; Elshenawi & Elazeem, 2020; Shahrokhi et al., 2013; Aygin & Cengiz, 2011; WHO, 2002; Rohde& Domm2018), consisted of 19 questions measuring factors such as having received drug-drug interaction training, the training program received, drug-drug interaction information and awareness of needs, the way of obtaining information about combination drug administration, the source of information applied in case of drug interaction, the information that drug-drug interaction is included in the drug error classification, whether

nurses are legally responsible, information on drug-drug pairs they frequently encounter in drug-drug interaction, risk factors affecting drug-drug interaction, risky patient groups, drug management and patient-drug practices.

Nurse Observation Form

In the intensive care units of the hospital where the research was conducted, "nurse observation forms" were used, in which the follow-up and treatment of the patients were recorded. These forms are used by the nurse and include the medications and medical orders ordered by the physician. Medical orders and the application hours of the prescribed drugs are arranged by the nurse who cares for the patient. In the nurse observation forms, drug dosage, drug administration frequency and time, drug administration route or missed drug are given in detail. Observation forms were filled with the information obtained from the ICU nurses, based on the drugs administered to the patients and the application hours by the researcher.

Data Analysis

The data obtained from the study were evaluated with the Statistical Package for the Social Sciences (SPSS) 22.0, and the data of the nurses working in the intensive care units were expressed as numbers and percentages. All data were in the normal distribution range and Chi-square test was used in the analysis of the data. In the statistical evaluation, 95% confidence level ($p < 0.05$) was accepted.

RESULTS AND DISCUSSION

It was determined that 87.6% of the nurses participating in the study were women, 46.2% were between the ages of 20-29, and 75.8% were undergraduate graduates. Of the nurses, 43.5% had work experience in the profession, 66.7% of them had 0-5 years of working experience in the same institution. 84.4% of the nurses worked in shifts day and night, and 78% of them worked as permanent staff.

In the study, 97.8% of the nurses reported that training should be given about drug-drug interactions, 44.6% reported that drug-drug interactions were not a drug error, 42.5% reported that they were medication errors, and 12.9% had no idea about the subject (Table 1).

Considering the presence of participants who gave more than one answer when the nurses participating in the study were asked about the drug-drug interaction to, it was observed that 45.2% of the nurses reported that drug-drug interaction was a drug administration that changed the patient's drug response, 9.7% was a side effect of the drug, 29% reported immediate allergic reactions in the patient, and 28.5% reported adverse drug reactions in the patient (Table 2).

For the open-ended question about the drugs that the nurses frequently encounter in drug-drug interactions, 76.3% of the nurses reported that they did not know about any drug-drug interactions (Table 2).

When the potential drug-drug interaction practices of the nurses participating in the research were examined, nurse observation forms were used to determine drug-drug interactions. According to Figure 1, it was determined that 65.6% of the nurses did not practice potential drug-drug interactions, and 34.4% of them performed potential drug-drug interaction practices.

When the drugs administered were examined, it was determined that 65.6% of the nurses did not apply potential drug-drug interaction, 21% applied the potential drug-drug interaction once, and 13.4% applied the potential drug-drug interaction 2 (two) times.

When the potential drug-drug interaction practices of the nurses participating in the study were compared with their staff status (p=0.286) and working style (p=0.052), it was determined that there were no significant differences (Table 3).

When the potential drug-drug interaction practices of the nurses participating in the study were compared with the duration of work in the institution (p=0.905), the duration of work in the intensive care unit (p=0.414) and the duration of work in the profession (p=0.304), it was found that there were no significant differences between them (Table 3).

When the potential drug-drug interaction practices of the nurses participating in the study were compared with the intensive care units they worked in (p=0.043), it was determined that there were significant differences between them, and more drug-drug interactions were encountered in the internal intensive care units (Table 4). The drugs administered by the nurses participating in the study in the unit they work were examined in terms of DDI, and the findings are given in Table 5.

DISCUSSION

DDI is an important medical problem that can change the effect of drugs, increase morbidity and mortality by threatening human life, and prolong the recovery period of the patient (Oğlu et. al., 2016). Drug administration, which has an important place in nurses' responsibilities, plays a key role in reducing medication errors (Dickens et al., 2008). In the job description specified in the intensive care nursing regulation in Turkey, it is emphasized with the law numbered 27910 that intensive care nurses should administer drugs, observe the patient in terms of the effects and side effects of drugs, and take appropriate actions when an undesirable effect is observed (T. C. Nursing Regulation, 2010). When the findings of our study are evaluated, when the drug-drug interaction practices of the nurses and their staff status, working styles, working hours in the institution, working time in the profession and working time in the intensive care unit are compared, it can be said that these factors are not effective on the nurses' performance of DDI. Therefore, it can be considered that drug-drug interactions are among the basic educational requirements.

Contrary to the literature, it was determined that the majority of the nurses participating in the study did not know that drug-drug interactions were defined as drug errors (Table 1). When examining the literature, Aydın et al., in their study on nurses' knowledge about drug errors, determined that the majority of nurses (82.5%) knew that drug-drug interaction was a drug error (Aydın et al., 2017). Kırşan et al. stated that drug-drug interaction is among the most common drug errors in the literature review including drug errors in nursing practice (Kırşan et.al., 2019). In the context of drug errors classification according to WHO, drug-drug interactions and drug-food interactions are included in the undesirable drug reaction (WHO, 2002). It is a very risky and remarkable situation that nurses do not know drug interactions as drug errors.

It was determined that more than half of the nurses participating in the study did not know DDI (Table 2). In the related field, Elshenawi and Elazeem (2020) reported that more than half of the nurses were not aware of their DDI status in their study on the awareness of DDI (Elshenawi &Elazeem, 2020). Zarea et al. (2018), in their study on the types of drug errors by Iranian nurses, revealed that 36% of nurses applied more than one drug without investigating the drug-drug interaction (Zarea et al., 2018). When the studies are examined, it is seen that

the nurses' knowledge of drug-drug interaction is insufficient and it is emphasized that this situation poses a high risk.

It was determined that 34.4% of the nurses participating in the study applied potential drug-drug interaction (PDDI), that 21% applied PDDI once on the same patient, and 13.4% applied 2 (two) PDDIs on the same patient, and drug pairs administered to patients posed a potential risk of drug-drug interaction (Figure 1). In the related field, in the study conducted by Elshenawi and Elazeem (2020) on nurses' awareness of DDI, it was determined that more than half of the nurses witnessed patients experiencing drug-drug or drug-food interaction, 29.8% encountered it once, 34% twice, and 25% several times (Elshenawi &Elazeem, 2020). The most important finding of our study is that potential drug-drug interactions can occur frequently.

When the PDDI practices of the nurses participating in the research were examined, it was determined that the nurses working in the Internal Intensive Care Units and then the Surgical Intensive Care Units applied it the most, and the PDDI practices were performed by the nurses working in the Pediatric Intensive Care Units at least (Table 4). It can be said that this situation is caused by the number of drugs used by comparison between intensive care units, the critical condition of the patients, and the usage of drugs with a narrow therapeutic index. Elshenawi and Elazeem (2020) reported that nurses working in thoracic and cardiac surgery had higher awareness of drug-drug interactions and this was due to the fact that nurses working in related units were more likely to encounter polypharmacy (Elshenawi &Elazeem, 2020). In our study, this important difference can be attributed to the number of drugs administered by the nurses in the intensive care units participating in the study and the risky drugs. Increasing the number of drugs administered to patients increases the risk of potential drug-drug interactions.

Limitations of the Study

The limitations of the study were determined as the inability to generalize the results because the research tools were applied only to ICU nurses working in a research hospital, it did not cover other units of the institution, and the study was carried out in a single city center.

CONCLUSION

Among the results of this study, it was found that most of the nurses did not have knowledge of DDI. The participants were not aware that DDI is included in the classification of drug errors, and a significant portion of the nurses perform PDDI. In this context, it was seen that PDDI practices are a situation that nurses may encounter frequently. Furthermore, in our study,]there were significant differences between the intensive care units where PDDI was applied and that these differences were caused by the number of drugs, the usage of drugs with a narrow therapeutic index, and the clinical conditions of critically ill patients. In this direction, it is recommended that nurses should be given training on DDI in undergraduate education processes and in-service training. In addition, the pharmacology of drugs, knowledge of drugs with a narrow therapeutic index, risky drug groups, and drugs containing DDI couples should be included in the education content.

ETHICAL ASPECT OF THE STUDY

Ethics committee approval was obtained from "A Publıc University Health Sciences Institute Scientific Research and Publication Ethics Committee (Decision no: 2016/5-11) and the necessary written permissions were obtained from the hospital where the research would be conducted. The nurses participating in the research were informed by the researcher that the

research was planned to examine the knowledge and practices of nurses about drug-drug interaction, and it was explained that all information of the participants would be kept confidential and their consent was obtained.

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REFERENCES

Varon, J. (2016). Approach to the intensive care unit (ICU). In *Handbook of Critical and Intensive Care Medicine* (pp. 1-10). Springer, Cham. https://doi.org/10.1007/978-3-319-31605-5_1

Neuraz, A., Guérin, C., Payet, C., Polazzi, S., Aubrun, F., Dailler, F., ... & Duclos, A. (2015). Patient mortality is associated with staff resources and workload in the ICU: a multicenter observational study. *Critical care medicine*, *43*(8), 1587-1594. https://doi.org/10.1097/ccm.0000000000001015

Cheragi, M. A., Manoocheri, H., Mohammadnejad, E., & Ehsani, S. R. (2013). Types and causes of medication errors from nurse's viewpoint. *Iranian journal of nursing and midwifery research*, *18*(3), 228. https://pubmed.ncbi.nlm.nih.gov/23983760

Di Muzio, M., Tartaglini, D., Marzuillo, C., La Torre, G., & De Vito, C. (2016). Knowledge, attitudes, behaviour and training needs of ICU nurses on medication errors in the use of IV drugs: a pilot study. *Signa vitae: journal for intesive care and emergency medicine*, *11*(1.), 182-206. https://www.signavitae.com/articles/10.22514/SV111.052016.13

Moyen, E., Camiré, E., & Stelfox, H. T. (2008). Clinical review: medication errors in critical care. *Critical care*, *12*(2), 1-7. https://pubmed.ncbi.nlm.nih.gov/18373883

Merino, P., Martín, M. C., Alonso, A., Gutiérrez, I., Álvarez, J., Becerril, F., & SYREC Study Investigators. (2013). Medication errors in Spanish intensive care units. *Medicina Intensiva (English Edition)*, *37*(6), 391-399. https://doi.org/10.1016/j.medine.2012.11.004

Bista, D., Saha, A., Mishra, P., Palaian, S., & Shankar, P. R. (2009). Impact of educational \intervention on the pattern and incidence of potential drug-drug interactions in Nepal. *Pharmacy practice*, *7*(4), 242. https://doi.org/10.4321%2Fs1886-36552009000400008

Gülhan, R. (2013). Yaşlılarda akılcı ilaç kullanımı. *Okmeydanı Tıp Dergisi*, *29*(2), 100-101. https://doi.org/10.5222/otd.supp2.2013.099

Lima, R. E. F., & Cassiani, S. H. D. B. (2009). Interacciones medicamentosas potenciales en pacientes de una unidad de terapia intensiva de un hospital universitario. *Revista Latino-Americana de Enfermagem*, *17*, 222-227. https://doi.org/10.1590/S0104-11692009000200013

Hammes, J. A., Pfuetzenreiter, F., Silveira, F. D., Koenig, Á., & Westphal, G. A. (2008).

Potential drug interactions prevalence in intensive care units. *Revista Brasileira de terapia intensiva*, 20(4), 349-354. https://doi.org/10.1590/S0103-507X2008000400006

Reddy, B. (2006). Potential drug interactions: recognising and minimising the risks. *Nurse Prescribing*, 4(10), 424-427. https://doi.org/10.12968/npre.2006.4.10.22320

European Medicines Agency. (2010). European Medicines Agency guidelines on the investigation of drug interactions.

Şimşek, A., Taner, N., Macit, Ç., Berk, B., & Mercanoğlu, G. (2019). The importance of computerized drug interaction checker programs used in community pharmacies to avoid potential drug interactions: a preliminary study with clarithromycin. http://doi.org/10.4274/imj.galenos.2018.45712

Harrington, A. R., Warholak, T. L., Hines, L. E., Taylor, A. M., Sherrill, D., & Malone, D. C. (2011). Healthcare professional students' knowledge of drug-drug interactions. *American journal of pharmaceutical education*, 75(10). https://doi.org/10.5688/ajpe7510199

Palleria, C., Di Paolo, A., Giofrè, C., Caglioti, C., Leuzzi, G., Siniscalchi, A., ... & Gallelli, L. (2013). Pharmacokinetic drug-drug interaction and their implication in clinical management. *Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences*, 18(7), 601. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3897029/

Fulton, M. M., & Riley Allen, E. (2005). Polypharmacy in the elderly: a literature review. *Journal of the American Academy of Nurse Practitioners*, 17(4), 123-132. https://doi.org/10.1111/j.1041-2972.2005.0020.x

Magro, L., Moretti, U., & Leone, R. (2012). Epidemiology and characteristics of adverse drug reactions caused by drug–drug interactions. *Expert opinion on drug safety*, 11(1), 83-94. https://doi.org/10.1517/14740338.2012.631910

Roque, K. E., Tonini, T., & Melo, E. C. P. (2016). Adverse events in the intensive care unit: impact on mortality and length of stay in a prospective study. *Cadernos de saude publica*, 32, e00081815. https://doi.org/10.1590/0102-311X00081815

Aşcı, H., Sönmez, Y., Saygın, M., Cankara, F. N., Yeşilot, Ş., & Yıldırım, M. K. (2016). Investigation of the presence of potential drug-drug interactions in the adult intensive care unit: a retrospective study. *Süleyman Demirel Üniversitesi Tıp Fakültesi Dergisi*, 23(3), 87-96. https://search.trdizin.gov.tr/yayin/detay/253063/

Oksuz, E., Bugday, M. S., Soyalp, C., Karaaslan, E., Oto, G., Goceroglu, R. T., & Berber, I. (2019). Drug-drug interactions in intensive care units and potential clinical consequences of these interactions. *Annals of Medical Research*, 26(10), 2158-2163. https://annalsmedres.org/index.php/aomr/article/view/1809

Akıcı, A., & Kalaça, S. (2013). Topluma yönelik akılcı ilaç kullanımı. *Sosyal Güvenlik Kurumu Başkanlığı, SGK Yayın*, 93.

Dağtekin, G., Demirtaş, Z., Alaiye, M., Sağlan, R., ÖNSÜZ, M. F., IŞIKLI, B., ... & Metintaş, S. (2018). Birinci basamak sağlik kuruluşuna başvuran erişkinlerin akilci ilaç kullanim tutum ve davranişlari. *ESTÜDAM Halk Sağlığı Dergisi*, 3(1), 12-23. https://dergipark.org.tr/en/pub/estudamhsd/issue/39510/466118?publisher=estudam

Kiguba, R., Karamagi, C., Waako, P., Ndagije, H. B., & Bird, S. M. (2015). Rare, serious, and comprehensively described suspected adverse drug reactions reported by surveyed healthcare professionals in Uganda. *PloS one*, 10(4), e0123974. https://doi.org/10.1371/journal.pone.0123974

Jones, J. H., & Treiber, L. (2010). When the 5 rights go wrong: medication errors from the nursing perspective. *Journal of nursing care quality*, 25(3), 240-247. https://doi.org/10.1097/NCQ.0b013e3181d5b948

Uzun, Ş., & Arslan, F. (2008). İlaç uygulama hataları. *Türkiye Klinikleri J Med Sci*, *28*(2), 217-22. https://www.turkiyeklinikleri.com/article/tr-ilac-uygulama-hatalari-50365.html

İyigün, E., Taştan, S. (2015). Abrams'ın klinik ilaç tedavisi hemşireler için akılcı ilaç uygulamaları, İstanbul: Akademisyen Kitabevi,; 40-65.

Kaya, H., Turan, N., Çulha, Y., & Aydın, G. Ö. (2018). Yaşlı Bireylerde İlaç Yönetiminde Hemşirenin Rolü. *JAREN/Hemşirelik Akademik Araştırma Dergisi*, *4*(2), 120-126. https://jag.journalagent.com/jaren/pdfs/JAREN_4_2_120_126.pdf

Bueno, A. A. B., Caldas, C. P., Camerini, F. G., Fassarella, C. S., & Luna, A. A. (2020). Patient safety: potential drug-drug interactions caused by the overlapping of medications agreed by the nurse. *Revista de Enfermagem Referência*, *5*(3). https://doi.org/10.12707/RV20038

Elshenawi, H. A., & Elazeem, Y. F. A. (2020). Nurses' Awareness and Perception of Drug-Drug and Drug Food Interactions. *Evidence-Based Nursing Research*, *2*(2). https://doi.org/10.47104/ebnrojs3.v2i2.123

Karahan, A., Isik, S. A., Kav, S., & Abbasoglu, A. (2015). Oncology nurses awareness of drug interactions. *Asia-Pacific Journal of Oncology Nursing*, *2*(4), 271-275. https://doi.org/10.4103/2347-5625.164998

Palma, N. D., Campos, J. F., & Silva, R. C. D. (2020). Drug scheduling by nurses and drug interactions in patients with cardiovascular diseases. *Revista Brasileira de Enfermagem*, *73*(5), e20190307. https://doi.org/10.1590/0034-7167-2019-0307

Shahrokhi, A., Ebrahimpour, F., & Ghodousi, A. (2013). Factors effective on medication errors: a nursing view. *Journal of research in pharmacy practice*, *2*(1), 18. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4076895/

Who Safety of medicines a guide to detecting and reporting adverse drug reactions (2002). [cited 2021 October 1]. Availablefrom:https://apps.who.int/iris/handle/10665/67378

Rohde, E., & Domm, E. (2018). Nurses' clinical reasoning practices that support safe medication administration: An integrative review of the literature. *Journal of clinical nursing*, *27*(3-4), e402-e411. https://doi.org/10.1111/jocn.14077

Oğlu, M. G. İ., Küçükibrahimoğlu, E., Karaalp, A., Sarikaya, Ö., Demirkapu, M., Onat, F., & Gören, M. Z. (2016). Potential drug? drug interactions in a medical intensive care unit of a university hospital. *Turkish Journal of Medical Sciences*, *46*(3), 812-819. https://doi.org/10.3906/sag-1504-147

Dickens, G., Stubbs, J., & Haw, C. (2008). Delegation of medication administration: an exploratory study. *Nursing Standard (through 2013)*, *22*(22), 35. https://doi.org/10.7748/ns2008.02.22.22.35.c6356

T. C. Nursing Regulation, Official Gazette Date: 08.03.2010 Official Gazette Number: 27515

Kırşan, M., Korhan, E. A., Şimşek, S., Özçiftçi, S., & Ceylan, B. (2019). Hemşirelik Uygulamalarında İlaç Hataları: Bir Sistematik Derleme. *Turkiye Klinikleri Hemsirelik Bilimleri*, *11*(1). https://doi.org/10.5336/nurses.2018-62052

Zarea, K., Mohammadi, A., Beiranvand, S., Hassani, F., & Baraz, S. (2018). Iranian nurses' medication errors: A survey of the types, the causes, and the related factors. *International journal of Africa nursing sciences*, *8*, 112-116. https://doi.org/10.1016/j.ijans.2018.05.001