



Evaluation of Drug-related Knowledge and Clinical Skills among Future Healthcare Professionals

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MSI and MZI designed the study, performed the initial statistical analyses and wrote the protocol. Authors MZI, SR and NJA wrote the first draft of the manuscript. Authors MZI, NJA and SR managed and refined the analyses. Authors MZI and MSI revised the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: The main objective of this study was to determine and compare current drug-related knowledge and clinical skills in terms of medication error identification among future healthcare professionals.

Methods: Study participants were asked to identify errors in three different prescriptions. Around 15 minutes were given to complete the questionnaire without using any references in a classroom setting. The medication error identification rate was calculated based on the number of students that have identified the errors correctly.

Results: Among 225 respondents, significant differences were found between the three groups, i.e. Prescription 1 $p=0.001$, Prescription 2 $p=0.023$, Prescription 3 $p=0.024$. Pharmacy

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students had higher medication error identification rate compared to medical and nursing students.

Conclusion: Final year pharmacy students were found to have the best drug-related knowledge and clinical skills in terms of medication error identification.

Keywords: Clinical skills; drug-related knowledge; future healthcare professionals; patient safety.

1. INTRODUCTION

A medication error is any preventable event that can cause or lead to patients harm while the patients are under the supervision of a healthcare provider [1]. Types of medication errors include prescribing errors, medication administration errors, dispensing errors and patient compliance errors [2]. These errors can be due to lack of experience or knowledge about the medication, failure to apply the fundamental rules, misspelling a medication name and ignorance of important information such as patient allergy [3-5].

A medication error can result in devastating consequences such as compromising patients' confidence in the healthcare system, increase healthcare costs and may even result in morbidity, harm or mortality. It is the main cause of the adverse events in every 6.5% hospital admissions [6]. There had been several cases reported in which people being died or paralyzed due to wrong drug administrations like spinal injections, inappropriate dosage forms and fatal drug doses since 1985 [7,8].

A study done by Elkami et al. revealed that the majority of final year pharmacy students had a lack of knowledge about pharmacovigilance and adverse drug reactions [9]. In addition, it was found that physicians trainees depend on pharmacists to check all the medication errors in their prescriptions [10]. Even though drug treatments are the responsibility of both physicians and pharmacists, nurses are also involved when it comes to drug administration. According to Page and Mc Kinney, current pharmacology content is insufficient within the nursing program [11].

Hence, it is important to evaluate the medication error identification rate (MEIR) among medical, pharmacy and nursing students to further strengthen their clinical skills before they become practitioners in their respective fields. Information regarding the current level of drug-related knowledge and clinical skills among students in medication error identification (MEI) would

provide data in formulating strategies to improve patients' safety.

2. MATERIALS AND METHODS

This cross-sectional study was done at a private university in Pakistan. The research tool was adapted from a previous study after the author's permission [12] and was modified according to the local setting to achieve the desired objectives of this study. A total of 260 sample size was calculated using Raosoft software by stratified sampling method.

The questionnaire comprising of two parts, the demographic information and three prescriptions, was distributed to the students, the majority of them were in their final years. The questionnaire was revalidated by face, and content validity methods and reliability of the was examined by Cronbach's alpha. Respondents were first introduced to the purpose of the survey verbally. Inclusion criteria were those who passed the sixth semester and those who gave written consent.

The research tool included 3 prescriptions with additional patients' related information such as drug allergy, weight, diagnosis and current medications that enable them to choose the right answer. Prescription 1 consists of drugs that sound similar but had different indications. Clotrimazole is an antifungal medication, is often confused with Omeprazole which is indicated for gastro-oesophageal reflux disease (GERD). On the other hand, prescription 2 was made without any errors. The main aim of giving a prescription without errors was to discourage guessing. Since wrong dosing poses patients at a higher risk of adverse drug events, prescription 3 was made with a wrong dosing calculation. In this prescription, If any mistakes were found, respondents were then asked to choose a reason for their answers which include drug allergy, wrong dosage, wrong dosage form, wrong interval, drug interaction or wrong indication. Usually, studied students start reading pharmacology after 2nd semester and pharmacotherapy after 5th semester.

2.1 Statistical Analysis

The data were entered into SPSS 22.0 for analysis. Descriptive statistics were performed to evaluate the demographic information of respondents. The Chi-square test was used to measure the significance of group differences between medical, pharmacy and nursing students in identifying medication errors in the prescriptions.

3. RESULTS

Among 260 questionnaires, 225 were returned, representing 86.5% response rate. Table 1 describes the demographic information of the participants. The three professions were dominated by females (68%). Among respondents, 91.6% were less than 25 years of age. Since there was a higher Punjabi speaking community in the university, around 78.2% of all respondents were Punjabi speakers.

MEIR was found to have a significant association with professions, as shown in Table 2. The

significant difference was found between the three groups in their ability to identify errors for prescription 1 that contains medication with a wrong indication ($p=0.001$). Total correct responses for prescription 1 were 159 from all three professions. More pharmacy students were able to identify the error type correctly (73.5%) followed by medical (70.2%) and nursing students (64.4%). There was also a significant difference in identifying error ability for prescription 2 among the students ($p=0.023$). Total correct responses for prescription 2 were 182 from all three professions. Significantly, more pharmacy students (92.5%) and medical students (77.1%) were able to identify that the prescription was without any error as compared to the nursing students (60.0%). For prescription 3 with a wrong dosing calculation, again more pharmacy (78.3%) and medical students (62.1%) were able to identify the correct error type compared to nursing students (57.7%) with $p=0.024$. Total correct responses for prescription 3 were 155 from all three professions.

Table 1. Demographic characteristics of the study participants

Variables	Students	
	Frequency (N)	Percentage (%)
Gender		
Male	72	32.0
Female	153	68.0
Age		
≤25-year-old	206	91.6
>25-year-old	19	8.4
Mother tongue		
Punjabi	176	78.2
Others	49	21.8
Profession		
Medical	74	32.9
Pharmacy	106	47.1
Nursing	45	20.0
Level of study		
7 th semester	57	25.3
7 th semester above	168	74.7
Satisfied with profession		
Yes	191	84.9
No	34	15.1
Socioeconomic status		
Low	15	6.7
Middle	163	72.4
High	47	20.9

Table 2. Correlation between correct response and professions

Prescriptions	Profession			p-value
	Medical	Pharmacy	Nursing	
P1	52(70.3)	78(73.6)	29(64.4)	0.001*
P2	57(77.0)	98(92.5)	27(60.0)	0.023*
P3	46(62.2)	83(78.3)	26(57.8)	0.024*

*p-value of <0.05 as significant

Table 3 showed that a significant association ($p=0.033$) was present between the correct response and study level for prescription 1 but no significant differences were observed for the rest of the prescriptions.

Table 4 illustrated a significant association between the correct response and satisfaction with the profession for prescription 1 and 2 ($p=0.019$ and $p=0.005$, respectively) but no significant differences were observed for the third prescription.

4. DISCUSSION

This study showed that pharmacy students had the best skills in identifying errors in prescriptions, as shown in Fig. 1. Pharmacy curricula are mainly medication-related and mainly focusing on the adverse effects, dosing, and mechanism of actions of the drugs. Furthermore, usually, more time is spent on pharmacology and pharmacotherapy case discussions in this program compared to other courses. In addition, pharmacy students are also exposed to the real-life setting of medication counselling, drug history taking, and prescription screening during pharmacy skills development. This further polishes their abilities to identify errors in prescriptions more effectively. A similar study was conducted by Warholak et al., in the United States had also found that out of the 3 students professions, the pharmacy had

significantly higher medication error identification rate than the rest [12].

Medical students, on the other hand, spend an average number of hours on drug-related subjects throughout their curricula. The extent of education in prescribing skills and patient safety practices in the syllabus is not that established. A study conducted by Walley and Wenn proposed that undergraduate medical programs have an inadequate profile of pharmacological education within the curriculum [13]. The significant difference was found in the ability of the three groups to correctly identify that prescription 2 contains no error. The main role of this prescription was to act as a control to determine whether error identification was based on individual knowledge or guessing. Surprisingly, medical and nursing students had lesser MEIR than pharmacy students. Despite having more drug-related knowledge, medical and nursing students may also have guessed by assuming that there must be an error in the prescription. Many medical students were also found to choose the wrong answer for prescription 3 compared to pharmacy and nursing students. This reflects a lack of calculation skills among medical students. An investigation by Dean et al., supported this finding that error may occur among doctors through rule-based mistakes, especially those that require dosage calculation [14] Poor mathematical skills can contribute to an increased risk of medication errors.

Table 3. Correlation between correct response and study level

Prescriptions	7 th semester	7 th semester above	p-value	OR	95%CI
P1	33(20.8)	126(79.2)	0.033*	3.56	1.54-1.41
P2	37(20.3)	145(79.6)	0.545	1.32	0.18-1.99
P3	29(18.7)	126(81.3)	0.111	1.01	0.05-1.87

*p-value of <0.05 as significant

Table 4. Correlation between correct response and satisfaction with the profession

Prescriptions	Yes	No	p-value	OR	95%CI
P1	132(83.0)	27(17.0)	0.019*	2.63	1.36-1.82
P2	168(92.3)	14(7.7)	0.005*	0.98	0.23-1.84
P3	132(85.2)	23(14.8)	0.333	0.78	0.12-1.35

*p-value of <0.05 as significant

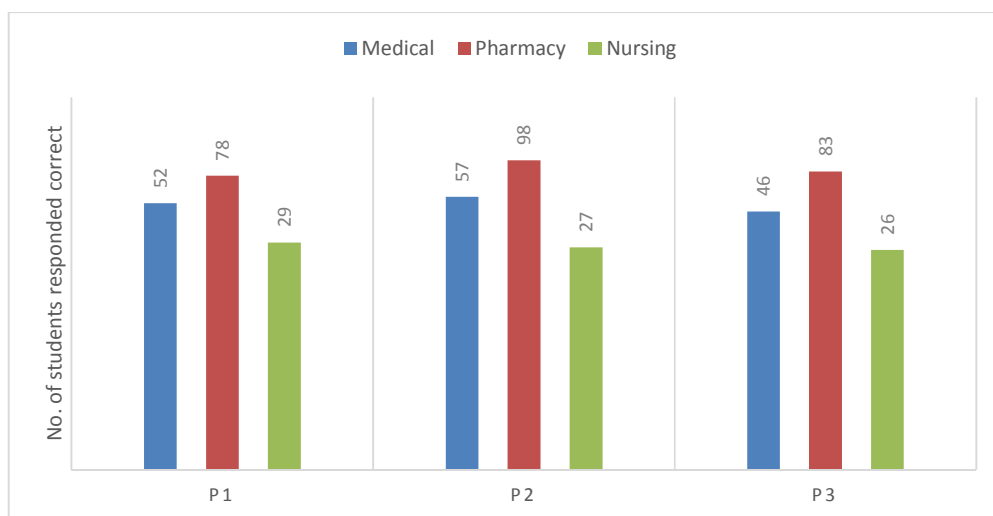


Fig. 1. No. of students in each profession who identified correct errors in the three prescriptions

Nurses are in the front line when it comes to drug administration [15]. The coverage of pharmacology and pharmacotherapeutics related subjects is much lesser in their 4-year program. Nursing students expressed their dissatisfaction with the time allocated for pharmacology in a study conducted by Morison and Griffith [16]. Error identifying skills are mostly learned through experience acquired during the clinical posting in each semester. This explains the ability of a few nursing students that identified errors in the 3rd prescription correctly. According to a review done by Koohestani and Baghcheghi, the most common cause of medication errors among nurses is the lack of pharmacological knowledge [17].

The medication errors can occur as a result of actions by physicians, nurses and pharmacist [2]. Most of the respondents were able to identify at least one error in the given prescriptions. However, without any working experience or training, these students had shown a low ability in identifying errors. Based on the findings of the study, some additional hours on pharmacological and pharmacotherapeutics could be incorporated in medical, pharmacy, and nursing curricula. Improving and continuous professional education may increase their skills to detect errors and hence, enhance patients' safety.

All students from different cohorts had been exposed to pharmacology and pharmacotherapy related subjects in the curriculum of each

profession. Pharmacy students answered all three prescriptions more precisely than the others as they are known as pharmacotherapy experts. In terms of drug safety, they are also more equipped with in-depth knowledge about pharmacovigilance, medication storage, posology, drug interactions, adverse drug reactions, drug regimens and different dosage forms than the rest of the students. Mostly pharmacology is integrated in earlier semesters for medical, pharmacy and nursing students [9-12]. Pharmacology and pharmacotherapy are the major subjects in the curriculum that would further help to decrease the number of medication errors among healthcare students [18]. The level of knowledge and their practical skills in these drug-related subjects result in significant differences in MEIRs among them.

5. CONCLUSION

The results of this study showed that pharmacy students had the best skills in identifying medication errors related to medication indication and dosage calculation than medical and nursing students. Differences among professions found in their ability to detect medication errors may be due to the number of hours allocated for pharmacology and pharmacotherapeutics. In order to attain patient safety regarding medication-related errors, the current curricula should more emphasize on drug-related knowledge and refining clinical skills of the future healthcare professionals.

6. LIMITATIONS

The sample population may not represent students in all universities in Pakistan as this study was only done at one private university. Besides that, only three prescriptions with two types of errors were used to measure the ability of future healthcare professionals in identifying errors. Respondents were not allowed to use any kind of references during the study, which itself does not reflect a real-life practice where they have direct access to various resources.

CONSENT

The consent was obtained from each participant before starting the study.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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