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Research Article

Knowledge and behavior of community pharmacists towards detecting drug-drug interactions

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ABSTRACT

Drug-drug interactions (DDIs) are preventable medication errors that can cause severe adverse effects for patients, which often involve more than one mechanism. Healthcare practitioners, especially community pharmacists, must know and manage potentially significant DDIs to provide patient safety.

This paper mainly aims to determine the knowledge level of community pharmacists about DDIs and to evaluate the behavior of community pharmacists in detecting DDIs. For this aim, a face-to-face questionnaire, including a knowledge assessment test containing 20 drug pairs and ten behavior statements related to detecting DDIs, was applied to community pharmacists.

Seventy-three pharmacists participated in the study. The study's findings show that the knowledge level of community pharmacists, who are the closest health consultants, about DDIs is relatively low. In addition, responses were found to be moderate in detecting drug interactions. Although statistically significant and positive effects of vocational training on the knowledge level and behaviors of pharmacists were determined, it was revealed that education levels did not have a significant effect.

In this regard, it is essential to improve community pharmacists' DDI knowledge level through vocational training programs and encourage their interaction-detecting behavior to improve patient outcomes and patient safety.

Keywords: Community Pharmacy, Drug-Drug Interaction, Knowledge, Behavior

1. INTRODUCTION

Drug-drug interaction (DDI) is the situation in which the effect of a drug changes qualitatively and/or quantitatively in the presence of another drug, food, beverage, or some environmental chemicals [1]. DDIs are preventable medication errors that can cause severe adverse effects for patients, which often involve more than one mechanism. Three types of mechanisms are commonly seen: (i) pharmaceutical incompatibilities, (ii) pharmacokinetic drug-drug interactions, and (iii) pharmacodynamic drug-drug interactions [2]. The increased frequency of drug regimen complexity and polypharmacy in the last century and the negative outputs caused by this increase have made DDIs even more critical [3]. Priyanka et al. stated that DDIs might cause unexpected side effects of the interacting drug or a desirable enhanced action [4].

Healthcare practitioners,especially community pharmacists, are uniquely positioned with their medication knowledge and role in prescription clinical assessment and must know and manage potential significant DDIs to provide patient safety [5]. Abarca et al. and Chatsisvili et al. stated that pharmacists are vital in preventing the harmful effects of DDIs, especially for drugs with narrow therapeutic index [6,7].

Therefore, the motivation for the present study comes from filling the gap in the literature. This paper mainly aims to determine the knowledge level of community pharmacists about DDIs and to evaluate the behavior of community pharmacists in detecting DDIs. In addition, it is aimed to test the following hypotheses in the study.

H_1: Participating a vocational training on DDI affects pharmacists' DDI knowledge in a positive way

H_2: Participating a vocational training on DDI affects pharmacists' interaction-checking behavior in a positive way

H_3: Education levels of pharmacists affect their DDI knowledge in a positive way

H_4: Education levels of pharmacists affect their interaction-checking behavior in a positive way

H_5: DDI knowledge level of pharmacists affects pharmacists' interaction-checking behavior in a positive way

2. MATERIALS AND METHODS

This study was conducted after Van YüzüncüYıl University Non-interventional Research Ethics Committee approved the study ethically (Date:19/11/2021, Decision No: 2021/12-1). Within the scope of this study, a face-to-face questionnaire was applied to community pharmacists affiliated with the Van-Bitlis-Hakkari Chamber of Pharmacists.One of the authors administered the questionnaires in the working environments of pharmacists in January-May 2022.

The questionnaire consists of three parts. In the first part, the demographic characteristics of the pharmacists were asked. In the second part, a knowledge assessment test including 20 drug pairs commonly stated in the relevant literature, and pharmacists were asked to classify the drug pairs as (1) contraindication, (2) may be used together with monitoring, (3) no interaction, and (4) not sure (to avoid guessing) [8-12]. The last part of the questionnaire contains ten behavior statements for detecting DDIs prepared by 5 points Likert scale.

The population of the study is consisting nearly 222 community pharmacists. The sample size of this study was calculated using the acceptable error level method under the assumption that the sample statistics are normally distributed. The sample size was calculated as 67 by taking a 0.10 confidence level, z=1.96, d (sensitivity)=0.05, and p and q values as 0.50. To increase the reliability of the study's results, it aimed to reach the maximum number of pharmacists that can be achieved, and the participation of 73 community pharmacists was ensured.

Pharmacists' knowledge scores were calculated, giving five for each correct answer and zero for each incorrect answer in the knowledge assessment test. Knowledge scores are classified as: (i) 0-25 very low, (ii) 26-50 low, (iii) 51-75 moderate, and (iv) 76-100 high.

The statistical significance was considered as $p< 0.05$ and 95% confidence interval.

3. RESULTS AND DISCUSSION

Seventy-three pharmacists participated in the study, of which 36% were female and 64% were male. 67% have a bachelor's degree, 26% have a master's degree, and 7% have a doctorate degree. In addition, 46% of them attended a vocational training program on DDIs. Considering the frequency of encountering DDI in the prescriptions per month, it was determined that 65% had one or fewer, 22% had 2-5, and 13% had five or more interactions.

Percentages of correct answers for drug pairs are given in Table 1.

According to Table 1, the drug pair with the highest number of correct responses by pharmacists was Sildenafil-Isosorbylmononitrate, with a 55% correct response rate. However, the least correct response rate (approximately 11%) was seen in Phenobarbital-Methyldopa and Amiodoran-Fluconazole. In the literature, the drug pairs to which pharmacists respond correctly vary in studies dealing with the knowledge level of pharmacists about DDIs. According to Alrabiah et al., pharmacists mostly answered the warfarin-cimetidine pair correctly (59.7%) [11]. Additionally, Oğuz and Arslan found that the pharmacists mostly gave correct answers for the warfarin-cimetidine pair in both the pre-test and post-test [13]. In contrast, in the study of Ko et al., this drug pair was the pair with the least correct answer [8]. As seen from Table 2, this pair's correct answer rate is relatively low in this study. Also, it is seen that the drug pairs with low correct response rates are similar to the study of Oğuz and Arslan [13].

When the knowledge scores of the pharmacists were evaluated, it was seen that the highest score was "80" and the lowest score was "0". The mean score was calculated as 24.8. The distribution of knowledge scores of pharmacists can be seen in Figure 1.

It should be noted that the knowledge score of 13 pharmacists was"0," and only four had scored over moderate level. In light of these findings, it is seen that the participants' level of knowledge about DDIs is low. This situation is paralel to the literature evaluating pharmacists' knowledge of DDIs [11,14].

In the study conducted by Oğuz and Arslan to reveal the effect of an educational intervention on DDIs for senior pharmacy faculty students, it is seen that the average knowledge scores of the students is 22.639 in the pre-test and 48.056 in the post-test [13].

In the next step of the study, the behaviors of pharmacists to identify DDIs are discussed with ten expressions, and the average response to these statements is given in Table 2.

Table 1. DDIs Knowledge Results

No	DrugPairs	Percentages of correctanswers (%)
1	warfarin -cimetidine	27.40
2	sildenafil –isosorbidemononitrate	54.79
3	alprazolam -itraconazole	24.66
4	warfarin -verapamil	24.66
5	theophylline -omeprazole	31.51
6	atenolol -ranitidine	30.14
7	digoxin - clarithromycin	19.18
8	cyclosporine -rifampicin	23.29
9	itraconazole -quinidine	21.92
10	methotrexate -probenecid	16.44
11	methyldopa -phenobarbital	10.96
12	amiodarone-simvastatin	27.40
13	pimozide -ketoconazole	17.81
14	dopamine -phenytoin	26.03
15	phenytoin -cimetidine	27.40
16	metformin -erythromycin	36.99
17	theophylline -ciprofloxacin	26.03
18	amiodarone -fluconazole	10.96
19	digoxin -warfarin	23.29
20	acyclovir -simvastatin	31.51

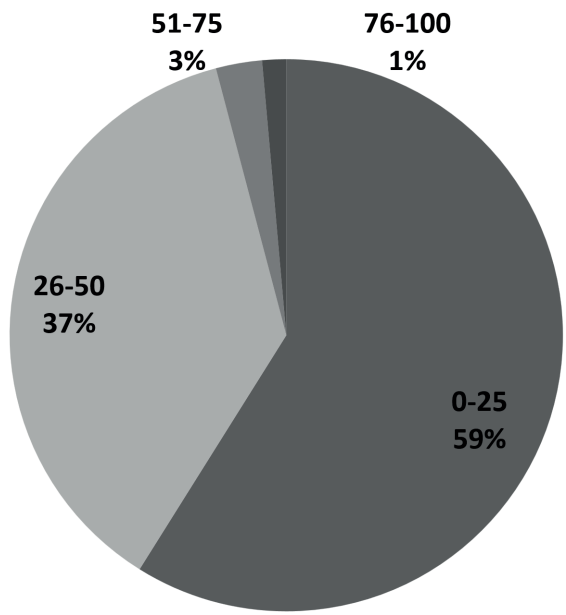

Figure 1. Knowledge scores

Table 2. Mean values

No	Items	Mean	Standard deviation
D1	I check for DDIs whilefilling prescriptions.	3.328	1.028
D2	I use electronic drug information resources while detecting DDIs.	3.521	1.203
D3	I use package inserts of the drugs while detecting DDIs.	3.164	1.106
D4	I use the internet while detecting DDIs.	3.220	1.325
D5	I counsel my patients on DDIs.	3.110	1.308
D6	I check whether there is an interaction between the drugs my patients are using and their prescribed drugs.	3.138	1.254
D7	When I encounter a DDI on a prescription, I contact the prescribing physician.	3.069	1.084
D8	When I encounter an interaction between the drugs my patients are using and their prescription drugs, I contact the prescribing physician.	2.890	1.318
D9	When I encounter a DDI in the prescription, I refer the patient to the physician.	3.178	1.124
D10	When I encounter an interaction between the drugs my patients are using and their prescription drugs, I refer them to the physician.	3.712	1.124

When Table 2 is examined, it is seen that the average of the responses given to the behavioral statements is at a moderate level. Considering the response frequencies of pharmacists, it has been determined that approximately 40% of them frequently check whether there is a drug interaction in the prescription, and they use electronic drug information sources at the highest rate in detecting drug interactions. Similarly, Dahri et al. revealed that pharmacists use different sources to detect DDIs and mostly prefer electronic databases [5]. Furthermore, parallel to Hamadouk et al. and Makkaoui et al., it is seen that pharmacists mostly prefer to refer patients to physicians when they encounter a DDI [15,16].

Following this, the data obtained from the behavioral expressions were subjected to explanatory factor analysis (EFA) by varimax rotation to determine underlying latent variables of interaction detection behavior. Five expressions were extracted from EFA, anda one-factor structure was obtained, which explained 54.532% of the variance. EFA results are given in Table 3. The Cronbach's alpha value was calculated as 0.776. This value shows that the obtained factor result is reliable.

Lastly, *t*-test and ANOVA tests were performed to determine the effects of demographic characteristics on the pharmacists' knowledge test scores and interaction detection behavior, and the results are presented in Table 4.

Table 3. EFA results

Item	Factor loadings	Cronbach's alpha
D7	0.834	
D1	0.829	
D6	0.748	0.776
D10	0.649	
D4	0.603	

Table 4. *t-test* and ANOVA results

	Participation in vocational training		Education level	
	t	**Sig.**	**F**	**Sig.**
Knowledge scores	2.590	0.012*	0.375	0.689
Interaction detection behavior	4.375	0.000*	2.610	0.0081

A statistically significant difference was found between the mean knowledge scores of pharmacists who participated in vocational training on drug interactions and those who did not, at the 95% confidence interval. It was determined that the averages of the pharmacists who participated in vocational training were higher than those who did not. In this regard, the first hypothesis of this study is confirmed. Similarly, Saverna et al., Harrington et al., and Hincapie et al. emphasized the importance of a drug-drug interaction-specific training program to improve the short-term drug-drug interaction knowledge of healthcare providers [9,17,18].

According to Table 4, it can be seen that participation in vocational training created a statistically significant difference in their interaction detection behavior. Therefore, the second hypothesis of this study is confirmed. This finding contrasts Akgöl and Baltacı Bozkurt's study, in which no relationship was found between pharmacy duties and vocational training participation [19].

Jose et al. stated that pharmacy education should encourage pharmacists about DDIs [20]. In contrast, there was no statistically significant difference in DDIs knowledge of pharmacists andtheir interaction detection behavioraccording to educational level in the 95% confidence interval. Herewith third and fourth hypotheses of the study are rejected.

In addition, it was determined that the knowledge scores of pharmacists in the 95% confidence interval did not create a statistically significant difference in interaction detection behavior. Considering that knowledge is among the antecedents that affect the behavior of individuals, it is expected that increasing the level of knowledge on this subject will contribute positively to the development of interaction detection behaviors of pharmacists. However, the findings reject the fifth hypothesis of the study.

4. CONCLUSION

With this study, the knowledge level of community pharmacists on DDIs was determined, and a measurement tool was presented to contribute to future studies in detecting drug interaction behaviors of community pharmacists. The study's findings show that the knowledge level of community pharmacists, who are the closest health consultants, about DDIs is relatively low. In addition, responses were found to be moderate in detecting drug interactions. Although the literature has stated that the knowledge level of pharmacists and other health professionals on this subject is low, the values obtained are far below expectations.

In this context, it is necessary to increase pharmacists' awareness of this issue during undergraduate education. Beside this, improving community pharmacists' DDIs knowledge level through vocational training programs and encouraging their interaction-detecting behavior to improve patient outcomes and protect patients from DDIs related problems is essential.

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Ethical approval

The study was approved by the Van YüzüncüYıl University Non-interventional Research Ethics Committee (Protocol no. 2021/12-1 / 19.11.2021).

Author contribution

Concept: FO, MA; Design: FO, MA; Supervision: MA; Materials: FO, MA; Data Collection and/or Processing: FO; Analysis and/or Interpretation: FO, MA; Literature Search: FO, MA; Writing: FO, MA; Critical Reviews: MA.

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Conflict of interest

The authors declared that there is no conflict of interest.

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