An Evaluation of the Knowledge, Attitude, and Behaviour to Pharmacovigilance in the Use of Antibiotics of Students in the Health Sciences Field

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Abstract

Background: Antibiotic resistance is a major problem worldwide. Misuse of antibiotics increases bacterial resistance. Therefore, pharmacovigilance education may contribute to rational antibiotic use
Purpose: The aim of this study was to evaluate the knowledge, attitude, and behaviour about pharmacovigilance in the use of antibiotics of university students in the field of Health Sciences and to determine related factors.
Method: This cross-sectional study was derived from a population of 2111 students in the field of Health Sciences during the 2019-2020 academic year. Using a simple randomization method, the sample included 1006 students who volunteered to participate in the study.
Results: A total of 682 (67.8%) students reported that they had used antibiotics within the last 6 months, and only 1 in 5 (20%) of the students had recommended others to use any antibiotic. According to the level of knowledge about antibiotic use, 64.2% of students considered antibiotics appropriate for viral infections. Recovery from coughs and colds was not thought to be accelerated by antibiotics, according to 30.1% of the students, whereas half stated that they completed the antibiotic dose in treatment even if they felt well. Unused antibiotics were reported to remain in the home by 56.5% of the students. A statistically significant difference was determined between the knowledge, attitudes and behaviours about antibiotic use of students who had and had not received education about pharmacovigilance**.**
Conclusion: The provision of pharmacovigilance education in all university departments and programs would make a positive contribution to rational drug use.
Keywords: Antibiotic use, Antibiotic resistance, Pharmacovigilance, Health, University students

Antibiotics have been accepted as one of the greatest discoveries of the 20th century for providing successful treatment of many infectious diseases. However, the efficacy of antibiotics is short-lived because of antibiotic resistance (Agarwal et al., 2015; McCormack & Allan, 2012). As a result of incorrect or over-use of antibiotics, antibiotic resistance has become an increasing problem worldwide and has caused an increase in healthcare costs (Al-Yamani et al., 2016). The Center for Disease Control (CDC) has defined antibiotic-resistant micro-

organisms, which create a disastrous threat to people in all countries of the world, as "nightmare bacteria (CDC, 2013). In a 2014 report related to antimicrobial resistance, there were stated to be 700,000 deaths per year because of resistance, and if precautions are not taken to reduce antibiotic use, it was predicted that this could increase to 10 million by 2050 (O'Neill, 2014). In recent years, points requiring attention to inappropriate drug use, and especially in the use of antibiotics, have been included in public health programs in many countries (Health Ministry, WHO, CDC).

After Greece, Turkey is among the countries with the highest antibiotic use (Republic of Turkey Ministry of Health, 2018). Currently there is a significant health problem of unnecessary, non-prescribed, and inappropriate antibiotics used because they are in the home or have been recommended to relatives or neighbours by a pharmacist (Çelik et al., 2010). Therefore, in 2015, the Republic of Turkey Ministry of Health decided to adopt a national approach to public education on the subject of antibiotic resistance and over-use or inappropriate use of antibiotics (Republic of Turkey Ministry of Health, 2015). Pharmacovigilance education started to be given to all healthcare professionals and students in the healthcare sector. The first precaution in these programs was for doctors and other healthcare professionals not to prescribe inappropriate drugs and not to use inappropriate doses and durations in treatment. The second precaution was for antibiotics not to be available without a prescription to prevent uncontrolled antibiotic use by the public. Inappropriate drug use such as antibiotic use without prescription and not completing a course of antibiotics, is frequently seen in Turkish society (Republic of Turkey Ministry of Health, 2015).

Pharmacovigilance is a discipline that was formed to provide safe and appropriate use of drugs (Alwhaibi & Al Aloola, 2020; Neelotpol et al., 2020). The success of a pharmacovigilance program depends on the active participation of healthcare professionals (Upadhyaya et al., 2015), because nurses, midwives and other healthcare professionals play a vital role in preventing the spread of resistant bacterial infections and in raising the awareness of antibiotic resistance (Sadasivam et al., 2016). Appropriate use of antibiotics is the most important factor in preventing antimicrobial resistance. Previous studies in the literature have reported that the participation of healthcare professionals in effective public health programs is necessary to provide patient safety, improve the quality of care, and know the side effects of the drugs used (Afzal Khan et al., 2013; Charani et al., 2010). It is also recommended that comprehensive education be given to students studying in the field of healthcare and that awareness of antimicrobial resistance is created (Sadasivam et al., 2016; Simpson et al., 2007).

Another factor affecting the adherence of healthcare workers to pharmacovigilance rules at the professional level is the appropriate use of drugs for themselves for treatment purposes and whether or not they ensure their own safety. It has been reported in the literature that healthcare professionals in many countries do not use drugs appropriately, primarily for themselves (Açıksöz et al., 2020; Csete et al., 2016; Saygılı et al., 2015).

The World Health Organisation has stated that healthcare professionals have a responsibility to know about the effects of antibiotics prescribed, the side effects, the correct dose and time of use, and storage conditions, and they should be educated on how antibiotic resistance develops (WHO, 2020). Students studying Health Sciences will serve in the future development of community health and welfare as members of a multidisciplinary healthcare team. These students will be responsible in the future for all health issues such as educating,

informing, counselling, and advocating antibiotic use to individuals and groups (Araz et al., 2022).

Previous studies in the literature which have examined antibiotic use by students of health sciences have reported that they generally needed training and had inaccurate knowledge, attitudes, and behaviours (Afzal Khan et al., 2013; Fejza et al., 2016; Lv et al., 2014; Saengcharoen et al., 2012; Scaioli et al., 2015).

It is thought that the inappropriate use of antibiotics by students for themselves will have a negative effect on their knowledge, attitude, and behaviour toward antibiotic use for patients and in clinics (Çelik et al., 2010; Koçyiğit et al., 2020). The aim of this study was to evaluate the knowledge, attitude, and behaviour about pharmacovigilance in the use of antibiotics among students in the field of Health Sciences in a Turkish public university and to determine the factors which may be associated with those aspects.

Method

Study design and participants

This cross-sectional study was conducted with students in the Health Sciences Faculty in the 2019-20 academic year. The study population was formed of a total of 2111 students (579 students in the nursing and midwifery departments, and 1532 students in the Anaesthesia, Physiotherapy, First Aid and Emergency Service, Geriatric Care, Medical Documentation, and Medical Laboratory departments). Using a defined sampling method, the minimum sample size was calculated as 506 students with 0.01 error margin and 95%confidence interval. Using the design effect sample size, it was aimed to reach a sample size 2-fold greater (n=1012).
The study inclusion criteria were defined as studying in the Health Sciences Faculty and voluntary participation in the study. Students were excluded from the study if they were studying Medicine or Pharmacy (due to the unequal pharmacology and pharmacovigilance course hours) or if they were unwilling to participate in the research.
The study was completed with a total of 1006 randomly selected volunteer students who met the criteria.

Data collection

A 30-item questionnaire prepared by the researchers was used to collect the data related to demographic characteristics (age, gender, department, year of study, employment status, income level, place of residence, the status of pharmacovigilance education received), self-use of antibiotics and practices, knowledge about antibiotics, and attitude and behaviour towards antibiotic use. The questionnaire was administered in face-to-face interviews. Preliminary testing of the questionnaire was conducted by applying it to 20 students who were not included in the research. After the preliminary test, the questionnaire was given its final form and started to be administered in face-to-face interviews, each of which took an average of 15-20 minutes. The researcher completed 40 interviews each day. The study was carried out between September 2019 and February 2020.

Data analyses

Data obtained in the study were analyzed statistically using SPSS version 24.0 software. Results were presented as number (n), percentage (%), and mean ± standard deviation (SD) values. The conformity of the data to normal distribution was assessed with the Kolmogorov-

Smirnov test. The relationships between the pharmacovigilance education status of the students and some independent categorical variables were analyzed with the Chi-square test. Data were presented in a 95% confidence interval, and a 0.05 error margin was accepted as statistically significant.

Ethical approval

Approval for the study was granted by the Clinical Research Ethics Committee of KSU. In accordance with the Helsinki Declaration, signed informed consent for voluntary participation in the study was obtained from all the students.

Results

Sociodemographic characteristics of the respondents

Table 1. Sociodemographic characteristics of the respondents

Data	n	%	Data	n	%
Age (years)			**Marital status**		
≤20	583	58.0	Married	31	3.1
≥21	423	42.0	Single	972	96.6
Gender			Widowed	3	0.3
Female	767	76.2	**Income level**		
Male	239	23.8	Minimum wage (2800TL)	383	38.1
Department of study			2801-3500TL	313	31.1
Faculty of Health	350	34.8	3501-4200TL	176	17.5
Vocational School of Health Services	656	65.2	≥4201TL	134	13.3
Year of study			**Place of residence**		
First year	523	52.0	Province	686	68.3
Second year	311	30.9	District	210	20.9
Third year	76	7.6	Rural	99	9.7
Fourth year	96	9.5	Abroad	11	1.1
Working status in a healthcare facility			**Status of receiving pharmacovigilance training**		
Yes	51	5.1	Yes	483	48.0
No	955	94.9	No	523	52.0
Total	**1006**	**100.0**	**Total**	**1006**	**100.0**

The students participating in the study comprised 76.2% females and 23.8% males with a mean age of 20.5±1.9 years, and 58% were aged ≤ 20 years. Of the total students, 65.2% were students in the Vocational School of Health Services, and 52% were in their first year of study. Almost all of the students were single and not employed. Half of the students had received pharmacovigilance education (Table 1).

Prior experience in antibiotic use

The experiences of the students related to antibiotic use and the associated data are shown in Table 2.

Table 2. Prior experience of antibiotic use

Data	Status of Receiving Pharmacovigilance Training					
	No		Yes		Total	
	n	%	n	%	n(%)**	X^2/p
Use of antibiotics prior to the last 6 months						
Yes	474	51.6	449	48.6	923(91.7)	1.800/
No	49	59.0	34	41.0	83(8.3)	0.110
Taking the antibiotic on time *						
Yes	207	48.4	221	51.6	428(44.3)	
No	92	60.4	61	39.9	153(15.8)	6.249/
Sometimes	198	51.3	188	48.7	386(39.9)	0.044*
Finishing the total dose of the antibiotic in the last 6 months						
Yes	137	27.5	112	23.9	249(25.7)	1.617/
No	362	72.5	357	76.1	719(74.3)	0.204
The use of any antibiotic at home without a doctor's prescription						
Yes	194	49.6	197	50.4	391(38.9)	1.441/
No	329	53.5	286	46.5	615(61.1)	0.128
Giving/recommending any antibiotic at home to a sick person						
Yes	108	53.7	93	46.3	201(20.0)	0.306/
No	415	51.6	390	48.4	805(80.0)	0.318
Time of taking antibiotics						
Before food	6	37.5	10	62.5	16(1.6)	5.809/
After food	232	48.9	242	51.1	474(47.1)	0.016*
According to doctor's instructions	221	53.9	196	47.0	417(41.5)	
Whenever it came to mind	64	64.6	35	35.4	99(9.8)	
Storage of antibiotics						
At room temperature	283	48.0	306	52.0	589(58.5)	10.940/
In the fridge	240	57.6	177	42.4	417(41.5)	0.001*
Toplam	**523**	**52.0**	**483**	**48.0**	**1006(100.0)**	

***Chi Square Test, p<0.05 ****Column percentage

Antibiotics had been used of all the students and prior to the last 6 months by 91.7% of all students. Antibiotic use without a doctor's prescription was reported by 38.9% of the students. Almost half of the students stated that the recommended time to take antibiotics was after food. Of those who took antibiotics on time, 51.6% had received pharmacovigilance education ($p<0.05$). Despite the statistical significance, pharmacovigilance education had not been received by 49.6% of the students who used any antibiotic in the home and by 53.7% of those who recommended any antibiotic in the home to others.

A statistically significant difference was determined between those who had and had not received pharmacovigilance education in respect of taking antibiotics on time ($p=0.044$), the

time of taking antibiotics (p=0.016), and the place where antibiotics are stored (p=0.001) (Table 2).

Knowledge about antibiotic use, adverse effects and resistance

Table 3. Knowledge, attitude, and behaviours about antibiotic use, adverse effects and resistance

	Pharmaco-vigilance education not received n(%)	Pharmaco-vigilance education received n(%)	Total n(%)*	X^2/p**
Use				
There is a need for different antibiotics for the treatment of different diseases (Yes)	338 (64.6)	340(70.4)	648(67.4)	4.498/ 0.106
Antibiotics are effective against bacteria. (Yes)	354(67.7)	370(76.6)	724(72.0)	12.764/ 0.002*
Antibiotics may kill bacteria which normally live on the skin or in the intestines (Yes)	267(51.1)	301(62.3)	568(56.5)	14.182/ 0.001*
Antibiotics accelerate recovery from coughs and colds (No)	147(28.2)	156(32.3)	303(30.1)	2.493/ 0.287
Antibiotics are effective against viruses. (No)	232(28.3)	158(43.9)	360(35.8)	27.387/ 0.001*
Adverse reactions				
If side-effects emerge during antibiotic treatment, this antibiotic must be terminated as soon as possible (Yes)	403(77.1)	379(78.5)	782(77.7)	6.137/ 0.470
If a skin reaction is seen during antibiotic use, the same antibiotic must not be used again (Yes)	412(78.8)	384(79.5)	796(79.1)	0.495/ 0.781
Antibiotics may cause an imbalance in the natural bacterial flora of the body (Yes)	307(58.7)	327(67.7)	634(63.0)	8.738/ 0.013*
Resistance				
Unnecessary use of antibiotics can increase resistance to bacteria. (Yes)	273(52.2)	283(58.6)	556(55.3)	4.766/ 0.092
Antibiotic resistance is a global problem (Yes)	315(60.2)	331(68.5)	646(64.2)	7.630/ 0.022*
The use of antibiotics in animals may reduce the antibiotic effect in humans. (Yes)	113(21.6)	106(21.2)	219(21.8)	1.631/ 0.442
People may be resistant to antibiotics. (No)	78(14.9)	52(10.8)	130(12.9)	6.137/ 0.047*
An antibiotic may not always be effective in the treatment of the same infection in the future. (Yes)	269(51.4)	255(52.8)	524(52.1)	0.187/ 0.911
Attitudes and Behaviours				
Antibiotics can be used without prescription. (No)	432(82.6)	405(83.9)	837(83.2)	4.059/ 0.131
I prefer to take antibiotics from a pharmacy without prescription. (No)	422(80.7)	404(83.6)	826(82.1)	2.634/ 0.368
I trust the doctor's decision when he is prescribing antibiotics. (Yes)	379(72.5)	343(71.0)	722(71.8)	1.164/ 0.559
I prefer to keep antibiotics at home in case they are needed later. (No)	231(53.7)	287(59.4)	568(56.5)	7.655/ 0.022*
I stop taking the antibiotic treatment when I think I have recovered (No)	269(51.4)	233(48.3)	502(50.0)	1.605/ 0.448
If I have had a cough for more than a week, I prefer to use antibiotics without a prescription (No)	304(58.1)	299(61.9)	603(59.9)	1.583/ 0.453
I prefer to use an antibiotic when I have some symptoms. (No)	298(57.0)	290(60.0)	588(58.4)	1.125/ 0.570

Doctors generally prescribe antibiotics on patient request (No)	118(22.6)	125(25.9)	243(24.2)	3.380/ 0.185

Number and percentages denote those who chose the correct response to the question all answers are "yes", no".*Row percentage **Column Percentage, ***Chi-square test, p<0.01"

Compared to students who had not received pharmacovigilance education, students who had received pharmacovigilance education had greater knowledge and were determined to have given correct responses, especially that antibiotics are effective against bacteria (76.6%), they can kill the bacteria normally living on the skin and in the intestines (62.3%), they are not effective against viruses (43.9%), they can cause an imbalance in the natural flora of the body (63%), antibiotic resistance is a global problem, and that people may not be resistant to antibiotics (52.8%) (p<0.001). Of the total students, 83.2% reported that they could not use antibiotics without a prescription, 82.1% that they would not prefer to take antibiotics from a pharmacy without a prescription, and 71.8% that they trusted the doctor's decision in prescribing antibiotics. A statistically significantly higher rate of students who had received pharmacovigilance education reported that they would not keep antibiotics at home in case of the need for future use (p<0.01) (Table 3).

Table 4. Multivariate logistic regression analysis with pharmacovigilange training as the dependent variable

Independent Variables	**B**	**SE**	**p**	**OR**	**%95 confidence intervals**	
					Lower	**Upper**
Antibiotics are effective against bacteria. (Reference Category: Yes)	0.562	0.227	0.013	1.755	1.126	2.736
Antibiotics may kill bacteria which normally live on the skin or in the intestines. (Reference Category: Yes)	0.467	0.169	0.006	1.594	1.145	2.220
Antibiotics accelerate recovery from coughs and colds. (Reference Category: No)	0.501	0.213	0.019	0.606	0.399	0.920
Antibiotics are effective against viruses. (Reference Category: No)	0.662	0.170	0.001	0.516	0.370	0.719
If a skin reaction is seen during antibiotic use, the same antibiotic must not be used again. (Reference Category: Yes)	0.640	0.323	0.040	0.526	0.279	0.989
People may be resistant to antibiotics. (Reference Category: No)	0.503	0.190	0.008	0.605	0.417	0.877
Doctors generally prescribe antibiotics on patient request. (Reference Category: No)	0.463	0.171	0.007	0.629	0.450	0.880

The data used were those that showed statistical significance in Table 4.

According to the multivariate logistic regression analysis, there was a higher probability that students who had received pharmacovigilance education would believe that antibiotics are effective against bacteria (OR:1.75), antibiotics can kill the bacteria normally living on the skin and in the intestines (OR:1.59), antibiotics will not accelerate recovery from coughs and colds (OR:0.60), antibiotics are not effective against viruses (OR:0.51), if a skin reaction develops

when using antibiotics, the same antibiotic should not be used again (OR:0.52), people will not be resistant to antibiotics (OR:0.60), and that doctors know correctly and do not generally prescribe antibiotics on patient request (OR:0.62) (Table 4).

Discussion

Those studying and working in the field of healthcare are groups who should be given education and role models in society in respect of the correct and rational use of antibiotics. According to the results of this study, students in the field of healthcare have some knowledge related to antibiotics which is extremely insufficient, and some knowledge is very superficial. Almost all (91.7%) of the students in the study had taken antibiotics before the last six months. This result is close to that of a similar study (88.9%) conducted on students in a Health Sciences Faculty. A significant proportion of the students (67.8%) reported that they had used antibiotics within the last 6 months. This result of antibiotic use within the last six months was similar to the findings of a study of university students in Nigeria (60.6%) (Ayepola et al., 2019). However, the current study result was found to be higher than the rate reported in a study of Health Sciences University students in Saudi Arabia (Zaidi et al., 2020). Antibiotic use is one of the main factors causing the development of antibiotic resistance. Therefore, decreasing the use of antibiotics is of vital importance in combatting antibiotic resistance (Olesen et al., 2018). A previous study reported that educational interventions contributed to increasing knowledge about pharmacovigilance (Bisht et al., 2020). In another study, it was stated that formal teaching to healthcare students about the correct use of antibiotics could minimize cases of antibiotic resistance (Rábano-Blanco et al., 2019).

In the current study, the majority of students who had and had not received pharmacovigilance education stated that they had not completed a course of antibiotics within the last six months. Consistent with this finding, the results of a questionnaire conducted by the World Health Organisation (WHO), which included 10,000 individuals in 12 countries, showed that approximately one-third (32%) of the respondents believed that they should stop taking antibiotics when they felt better rather than completing the prescribed treatment period (WHO, 2015). In contrast to the current study results, another study showed a high rate of individuals who believed that they should continue taking antibiotics even if symptoms had recovered (Kong et al., 2019). A positive increase has been reported in the knowledge and attitudes of those who receive pharmacovigilance education (Shrestha et al., 2020). In a review study conducted on healthcare workers, it was stated that healthcare service providers should have basic pharmacovigilance knowledge to be able to prevent serious health problems (Alwhaibi & Al Aloola, 2020).

In general, the majority of the students in the current study who had received and not received pharmacovigilance education displayed incorrect behaviours such as not taking antibiotics on time, not completing a course of antibiotics, giving antibiotics at home to another person, and only taking antibiotics when they remembered. This could be due to the majority of the students being first-year students, and more than half had not received pharmacovigilance education. However, for the students who had received pharmacovigilance, this could be because they had not fully understood the importance of correct antibiotic use or that the education received had not been sufficient. In a study of students in various fields of the healthcare professions, the majority of students wanted more information about antibiotic use,

stating that they needed more education on the subject of antibiotic use and resistance even in the years after graduation (Dyar et al., 2018). In another study of nursing students, it was reported that those who had received little education on the subject of antibiotic resistance increased their knowledge in subsequent training years (Rábano-Blanco et al., 2019).

In the current study, the probability of believing that antibiotics would not accelerate the recovery of most coughs and colds and would not be effective against viruses was found to be slightly lower in those who had not received pharmacovigilance education compared to those who had. However, this is not an isolated incident as both of these mistakes have been reported in studies conducted on both the general population (Igbeneghu, 2013; Jairoun et al., 2019) and on various healthcare disciplines (Afzal Khan et al., 2013; Akman, 2021; Ali et al., 2016; Dyar et al., 2018; Huang et al., 2013; Jamshed et al., 2014; Rábano-Blanco et al., 2019; Virmani et al., 2017). Therefore, the reason for the poor knowledge of students in various fields of healthcare could be that pharmacovigilance education is insufficient. Some previous studies have examined the knowledge, attitude, and behaviour about antibiotic use of students in different areas of healthcare and have generally found that the students had incorrect attitudes and behaviour and required education on the subject of antibiotic use (Afzal Khan et al., 2013; Fejza et al., 2016; Scaioli et al., 2015). Another study of medical students reported that the education they received about appropriate antimicrobial use and antimicrobial management was not sufficient, and the students wanted to have more education about antimicrobial management (Mersha, 2018). More than half of the current study participants correctly agreed with the statements related to the side effects of antibiotics. This rate has been found to be high in various studies (Awad & Aboud, 2015; Tiong & Chua, 2020).

That random use of antimicrobials can cause resistance was known by more than half of the students in the current study, and one in five knew that not completing the dose can lead to resistance. The level of knowledge of the students about resistance was seen to be lower than in some other studies (Jamshed et al., 2014; Okedo-Alex et al., 2019). While more than half (64.2%) of the current study students stated that antimicrobial resistance was a global problem, another study reported this rate as 98% (García et al., 2011). That antibiotic use in animals can reduce the antibiotic effect in humans was reported in this study at the rate of 78.2%, and that humans can be resistant to antibiotics at 87.1%. Similar results were obtained in another study (Awad & Aboud, 2015). Increasing the knowledge of students on these subjects could contribute to greater awareness of the subject of antibiotic use. A previous study showed that pharmacovigilance education made a positive improvement in knowledge and attitudes.

Almost three-quarters of the current study students reported that they trusted the doctor's decision to prescribe antibiotics. In a similar study in Sweden, this rate was higher, which was attributed to satisfaction with the doctor and treatment (André et al., 2010). In the current study, those who had received pharmacovigilance education stated at a significantly higher rate that they would not keep antibiotics at home in case of a later need for use ($p<0.001$).Similarly, in another study, it was determined that nursing students who participated in a training program on antibiotic management and infection control had a better understanding and practices on the subject of antibiotic use and antibiotic resistance (Jainlabdin et al., 2021). A study of healthcare students in Sri Lanka determined that as the level of education on this subject increased, so the students displayed more rational drug use behaviour (Sakeena, Bennett, Mohamed, *et al.*, 2018).

More than half of the students stated that doctors generally prescribed antibiotics because that is what the patient expected. Similarly, in various studies of adults, it has been shown that the prescribing behaviour of doctors is affected by patient expectations or the doctor's perceptions of those expectations (Kotwani et al., 2010; Kunin & Liu, 2002). Educational interventions for both patients and doctors can increase the knowledge and awareness of patients and decrease the frequency of inappropriate prescriptions of antibiotics by clinicians (Eng et al., 2003; Kotwani et al., 2010).

Conclusion

The results of this study demonstrated a statistically significant difference between the knowledge, attitudes and behaviours about antibiotic use among students who had received pharmacovigilance education and those who had not received such education. These findings indicate the lack of knowledge about antibiotics among university students studying in the field of healthcare.

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