Assessing the Awareness, Attitude, and Knowledge of Senior Pharmacy Students in Jordanian Universities Regarding Antibiotic Use and Resistance

Abstract

In order to address the issue of inappropriate antibiotic use, particularly in low- and middle-income countries, it is crucial to increase public awareness regarding the causes and consequences of antibiotic resistance (AR). This study aimed to assess the awareness, attitude, and knowledge of senior pharmacy students in Jordanian universities in relation to antibiotic use and AR. A proportionate random sampling method was employed, and a questionnaire was administered to 400 final-year pharmacy students from three universities in the northern region of Jordan. The findings revealed that the pharmacy students displayed a high level of knowledge, positive attitude, and responsible behavior towards antibiotic use, indicative of their awareness and understanding of the risks of AR.

Keywords: Antibiotics resistant, Antibiotic abuse, Senior pharmacy, Students awareness, self-medicating

Introduction:

The word 'antibiotic' is derived from the Greek words; 'anti,' meaning against, and 'bios,' which means life; in principle, antibiotics are molecules that eradicate the living organism. Nevertheless, in medical terms, antibiotics are substances that fight against bacteria [1]. Antibiotics are medications used to treat a bacterial infection, while an antimicrobial agent is a broad term that is referred to tackling infections caused by various bacteria, viruses, fungi, and parasites. Antimicrobials can be categorized into three subsets according to their sources [2]; antibiotics generated by other microorganisms (penicillin, macrolide, tetracyclines), chemically modified antibiotics (doxycycline, tobramycin), and chemically manufactured antibiotics (fluoroquinolones) [2]. Antibiotic resistance is a severe threat to global health and wealth. It is defined as the inability of antibiotics to work effectively against most bacteria [3]. According to the European Centre for Disease Prevention and Control, in 2018, an estimation

of around 33,000 people died yearly as a direct consequence of bacterial-resistant infection [4]. The emergence of resistance against antibiotics is a natural process found in microorganisms. However, its rate has increased significantly by different factors, such as; the misuse of antibiotics in humans and animals. The increasing resistance against the currently used antibiotics and the lack of new molecules in the pipeline to replace the old ones are two significant challenges in treating a bacterial infection in humans [5]. The threat posed by antimicrobial resistance is a progressive issue, estimated to cause 10 million deaths annually by 2050, which is higher than cancer [6].

In Jordan, there is relatively relaxed regulations on antibiotics use, it is easy to get antibiotics without a proper prescription (over-the-counter acquisition) [7]. Antibiotics are dispensed without an official prescription, and the absence of awareness results in the misuse of antibiotics within the Jordanian community. Antibiotic misuse is the crucial reason behind the abuse practice of self-medication and, subsequently the rise of antibiotic resistance within Jordanian society. Moreover, various antibiotics dispensed by pharmacists or requested by patients for the reason of self-medication are meant to treat clinical symptoms that frequently appear due to viral rather than bacterial infections, which also significantly impact the issue of bacterial resistance [8].

Researchers and scientists, including bacteriologists, have started to pay attention to social elements of antibiotic management, particularly the knowledge, attitude, and practice (KAP) amongst the general population concerning antibiotic use. However, only a few works have been published on the relationship between KAP and medical education. In this article, we analysed the present status of Jordanian Pharmacy students (PS) students' KAP on the use of antibiotics and assessed the influence of the Jordanian pharmacy curriculum on the correct usage of antibiotics among pharmacy students. These surveys reveal the general pharmacy students' understanding of the proper use of antibiotics. Thereby, it underlines the need to create specific regulations for public education on the use of antibiotics. Such regulations would help explain the proper practice of antibiotics to the public [9,10]. Arguably, the public plays an essential role in the use or abuse of antibiotics along with distributing these unsystematic tendencies [11]. Abdel-Qader et al. have pointed out that the Jordanian community generally had poor awareness and knowledge about antibiotics use and the term antimicrobial resistant. Therefore, socio-economic aspects could affect public attitudes regarding antibiotic use and antimicrobial resistance [12].

In recent years, pharmacy has undergone substantial development. Pharmacy duties used to be primarily centered on dispensing and mixing pharmaceuticals, with minimal emphasis placed on patient communication regarding their prescriptions or overall health state [13].

Nowadays, with addressing many issues regarding good pharmacy practice and clinical pharmacy in the medical world, pharmacists have mainly changed their attention to the necessity of interaction between the pharmacist and the patient [14]. In this framework, it becomes essential for the pharmacist to contribute to the public's health by preventing diseases, prolonging life, and promoting the health status of the entire population. These outcomes can be achieved by implementing good standards for health practice to provide the best pharmaceutical care for patients [15].

The future growth of the pharmacy profession depends on the area of pharmaceutical treatment [16]. In prior studies, "pharmaceutical care" was stressed as "The direct responsible provision of medication-related care to obtain specific outcomes that improve a patient's quality of life" [17]. However, the concept of pharmacological treatment still needs to be clarified in Middle Eastern Arabic-speaking nations. For instance, the public in the Sultanate of Oman acknowledged the need for improving services in neighborhood pharmacies [18]. In contrast, in the United Arab Emirates, several difficulties and hurdles to improving pharmacy services were observed [19].

This study aims to assess the percentage of senior pharmacists' students' awareness regarding antibiotic resistance in the Hashemite Kingdom of Jordan. We also aim to highlight the importance of the pharmacists` role in spreading this awareness. Furthermore, pointing to the issue of antibiotics misuse would hopefully alert Jordan's chief health regulatory bodies to implement more strict regulations regarding self-medicated antibiotics. Finally, our study assessed pharmacists' knowledge in recognizing the clinical symptoms of viral infections versus bacterial ones.

Methods

In this study, 400 students from 3 different universities in Jordan participated in the questionnaire survey on students' knowledge, attitude, and practice regarding antibiotic use. Chi-square test were used to analyze questionnaire-related discrete and categorical variables, respectively, to examine the impact of the pharmacy curriculum on students' KAP regards antibiotics. All the respondents were pharmacy students in their final year of study.

Questionnaire design and grading standards

The survey utilized a questionnaire specifically designed to assess fifth-year pharmacy students' comprehension of antibiotics. Its sole objective was to provide an overview of their understanding of antibiotics. The questionnaire consisted of 27 questions, which were categorized into four sub-sections: knowledge of antibiotics, attitude towards antibiotic use, perception of public education, and practices towards antibiotic use. These questions are included in Additional file 1. It is worth noting that the questionnaire was adapted from various studies [20].

The questions were classified as ‘right’ or ‘wrong’ for single-answer questions; the answer was built on the natural human situation. A lower dependency on antibiotics was demonstrated by answers, which is consistent with improved antibiotic usage habits.

(i) The first category (knowledge of antibiotic use) included 10 questions; these questions covered several sensitive topics, including but not limited to; the typical flora of microbes, the concepts of drug sensitivity and susceptibility, the connection between disease, drug resistance, and side effects of antibiotics, as well as opinions on the efficacy of antibiotics.

(ii) The second category (attitude toward antibiotic use) contained 5 questions covering the students' understanding of the risk associated with antibiotic abuse and its effects and side effects on the students and their family members.

(iii) The third category (the perception of public education) has 5 questions; these questions cover the knowledge degree of the participants about the sources and the information channels regarding antibiotics. In addition, it assessed their interest in learning more about these resources. Finally, this category also evaluated colleges` course arrangements and campaigns to promote correct antibiotic use from the students' point of view.

(iv) The fourth and last category (practice toward antibiotic use) which compose of 7 questions covered topics including how frequently antibiotics are used for fever, infections, and other symptoms, how well patients comprehend prescription medications and how often doctors write them, as well as how well they handle drug withdrawal. All questions are taken into consideration when comparing the overall results of each segment.

Results:

The survey was filled by 450 individuals, and after scanning them, 400 (88.88%) were deemed valid (with 80% of the questions in the survey answered) and found to be appropriate for analysis. Fifth grad students were targets from three different Jordanian universities.

The impact of medical curriculum on pharmacist knowledge of antibiotic use

According to the findings presented in Figure 1, a majority of pharmacists possess a clear understanding of antibiotic resistance. Hence, 86.25% of participants have prior knowledge of the phenomenon. Moreover, 90.4% of respondents are aware that antibiotics can only treat bacterial infections and not viral ones. Interestingly, 68.5% of pharmacy students believe that frequent antibiotic use is not beneficial in the treatment of infections, while 74% hold the view that newer and more expensive antibiotics are not necessarily more effective (Figure 1).

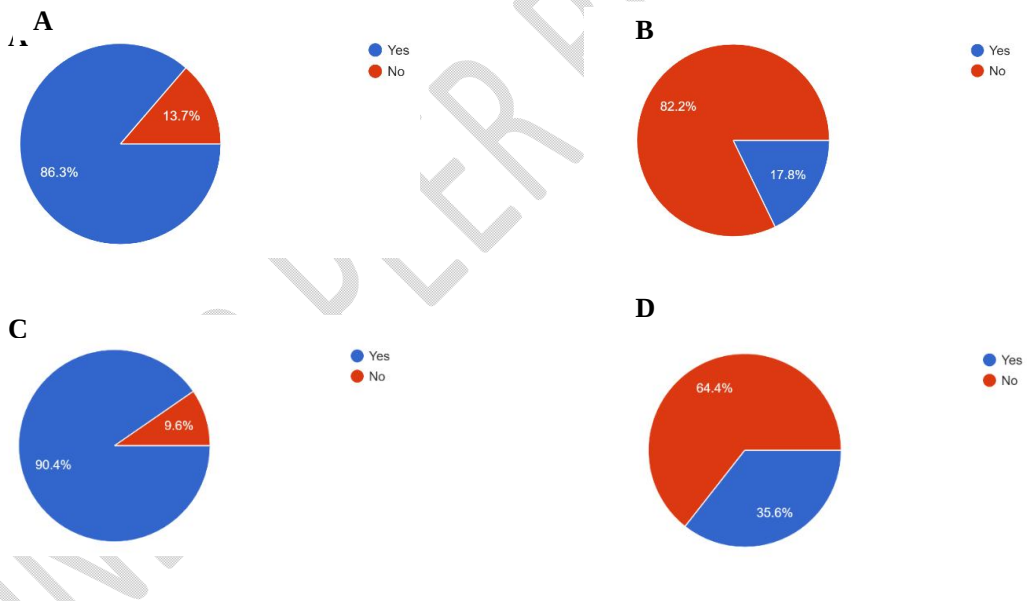

Figure 1: Responses to the statements: (A) "Have you heard of antibiotic resistance." (B) "Can antibiotics cure bacterial infections." (C) "Can antibiotics cure viral infections." (D) "Do you think frequent use of antibiotics will decrease the efficacy of treatment when using the antibiotic again."

The impact of medical curriculum on pharmacist attitude toward antibiotic use

The pharmacy students' opinion regards the root of antibiotics abuse are distributed as the following (Figure 2), 42.5% go with the universal principles of antibiotic use is not wide enough, and around half of the students see that drug manufacturers, hospitals, and other sectors, 74% choose that people think antibiotics can speed up the rehabilitation, while 39.7%

reveal that the cause of antibiotics abuse mainly due to loopholes in health, medicine regulation.

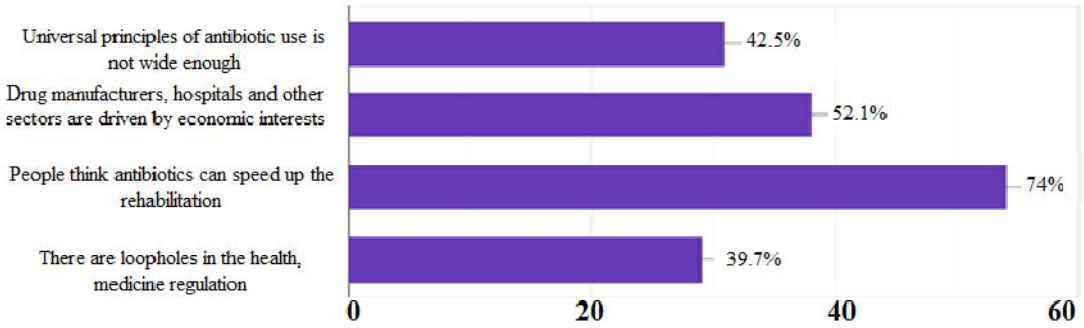

Figure 2: Responses to the statements: the root of antibiotic-cause abuse

The survey also shows that the abuse of antibiotics is a problem in Jordan, in concordance with one study conducted in Jordan showing the Jordanian community's poor understanding of antibiotics' effectiveness and resistance, especially in deprived areas[12]. Surprisingly, 312 (Supplementary material) students had seen a resistant case around them (Family and Hospitals), indicating that urgent action should be done to resolve the problem before it turned into a dilemma).

The impact of medical curriculum on pharmacist perception toward antibiotic use

The answers regarding the question of the source of information about the antibiotics were mainly from doctors and pharmacists, Moreover, most pharmacy students appreciate receiving drug information from professional medical workers (Figure 3).

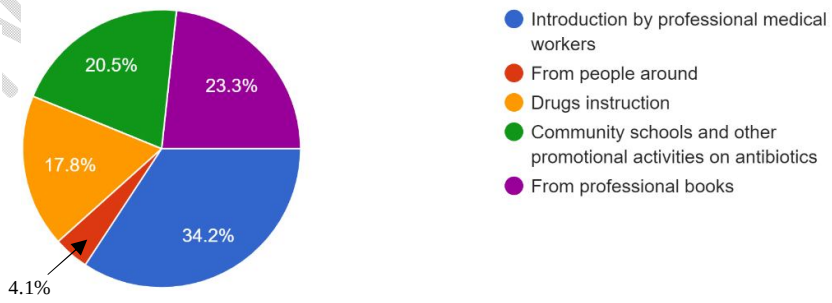

Figure 3: Responses to the statements: "The source that the students hope to get information about antibiotics"

Hence the antibiotics can be easily obtained and sold in Jordan without needing to provide a medical prescription to the pharmacist [7]. The pharmacist in Jordan thinks it is essential to spread awareness to the public using a reliable source of information (Figure 4).

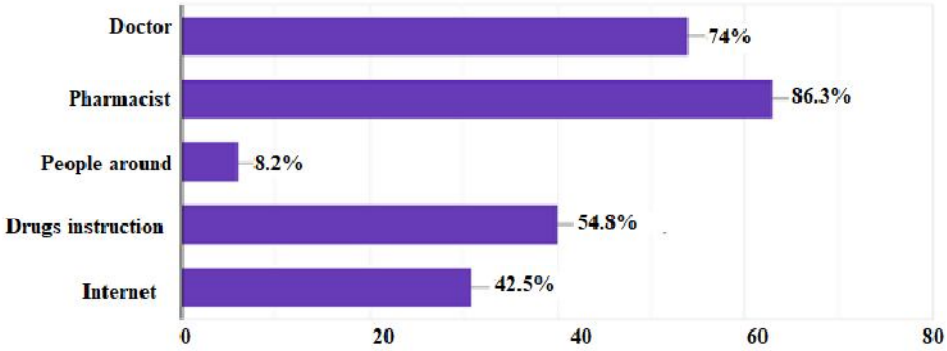

Figure 4: Responses to the statements: the information you can get about the antibiotics

More than 50% of the students believe that more information regarding antibiotics is needed. Moreover, information should be available about antibiotics. And the establishment of awareness sessions on the warnings of the use of antibiotics (Figure 5)

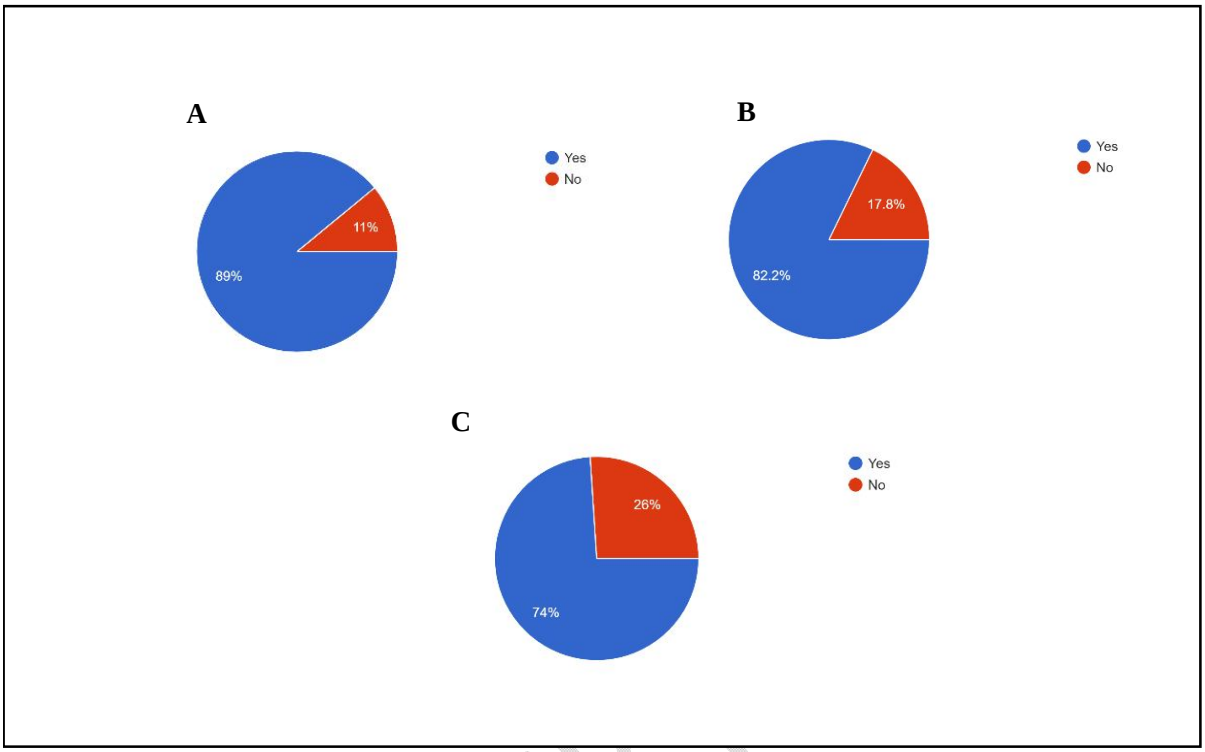

Figure 5: Responses to the statements:(A) "The necessity to get more information about antibiotics." (B) "The necessity to establish the course "Rational use of antibiotics" at the university level." (C) "The "antibiotics campaign" is a kind of large-scale science propaganda activity."

The impact of medical curriculum on pharmacist behavior toward antibiotic use

It is interesting to note that the percentage of the participant students avoided antibiotics in cases of experiencing coughing with yellow sputum, Sore throat, cough with fever, obstructed nose with headache, coughing up transparent phlegm, and cough lasting more than 2 weeks respectively.

Based on the figure (6), it is shown that the pharmacy students are aware that the unnecessary use of antibiotics will lead to resistance emerging. 45.20% of the students believe antibiotics shouldn’t be used even at high temperatures. Moreover, 76.7 % are unwilling to stop using antibiotics even in case of symptoms disappearance.

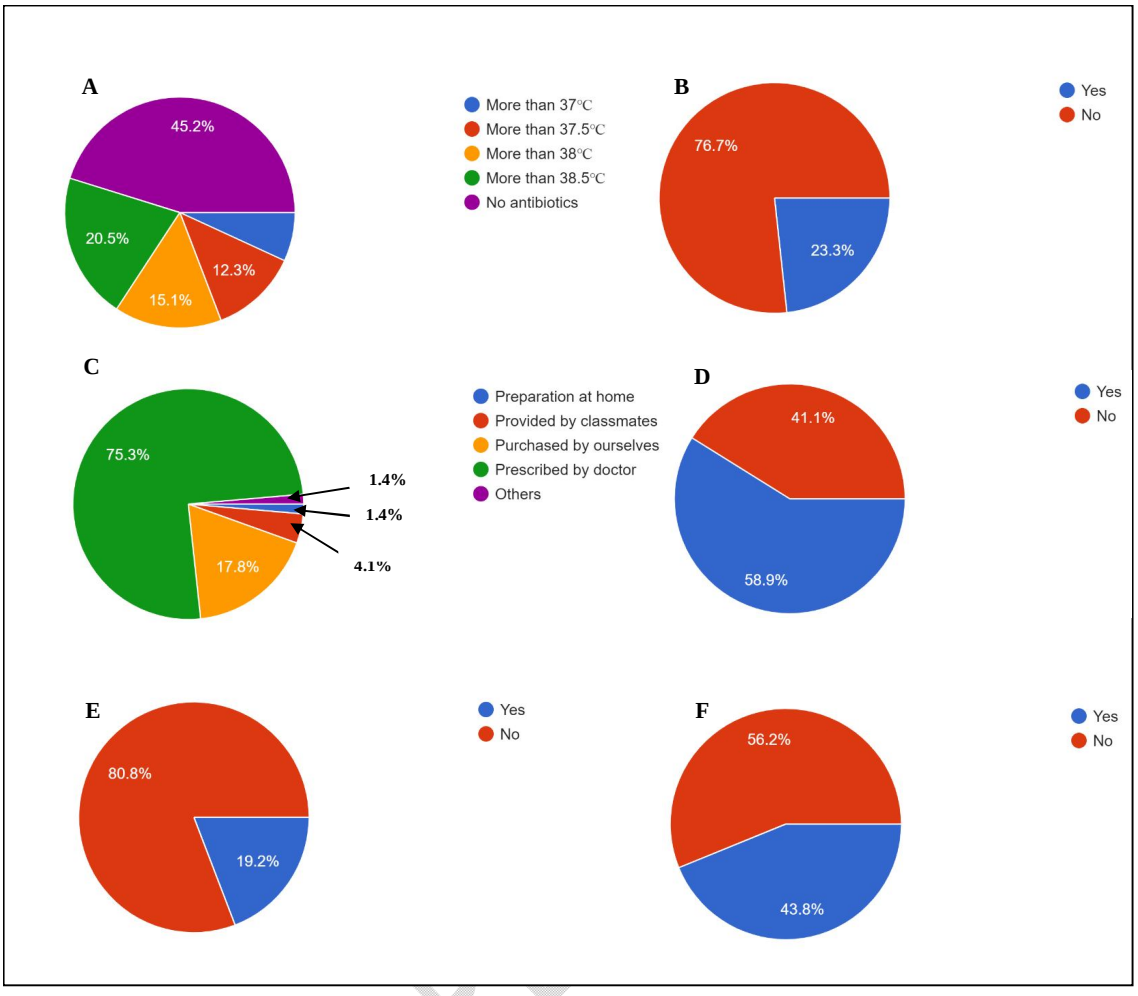

Figure 6: Responses to the statements:(A) "Use antibiotics when having fever (temperature below 38.5°)". (B) "Stop the use of antibiotics when the symptoms relieve." (C) "The source of antibiotics." (D) "Use antibiotics without a doctor's prescription." (E) "The ability to ask the doctor to prescribe antibiotics." (F) "The doctor's ability to write an antibiotic prescription."

75.30% of the students think that the antibiotc prescription supposes to be prescribed by physicians. Additionally, 41.0% of the students have antibiotics without a doctor's instruction. A very high percentage (80.80%) of pharmacy students will not ask the doctor to prescribe antibiotics. Interestingly 56.20% of the pharmacy students believe physicians will not prescribe antibiotics.

Discussion:

This study surveyed pharmacy students from three prestigious universities in the north part of Jordan to evaluate their knowledge, attitude, and practice regarding antibiotic use in the form of questionnaires. The pharmacy students provide promising results in knowledge, attitude,

perception, and behavior compared to the public education presented in Abdel-Qader study [12].

The result of knowledge studies displays that pharmacy students could obtain more information about antibiotics which is also shown in Ahmad et al study about the awareness of pharmacy students regarding the use of antibiotics [21]. The good knowledge is well presented by the relatively technical question about their knowledge in antibacterial resistance and the awareness about antibiotic cures the bacterial infection rather than viral similar results were achieved by Fejza et al [22].

One study promotes that antibiotic knowledge, attitude, and behavior are supposed to be improved in Jordan [23]. Most pharmacy students think that antibiotics cannot speed up the recovery of the common cold, cough, and several other related illnesses emerging due to viral infections. However, a few pharmacy students who believe that antibiotics can resolve the viral symptoms table (3). To improve their understanding of antibiotics, 82.20% of the pharmacy students in our study favored establishing a course on the prudent use of antibiotics at the university level in Jordan (Figure 5).

Interestingly the pharmacy students are highly aware of the public education about antibiotics; hence 82.2% believe that antibiotic resistance is a problem in Jordan, and 76.75% consider the main reason for antibacterial resistance is public abuse theses results are similar to Abdel-Qader [12]

A statutory license is required for practitioners of the profession known as a pharmacy to carry out specific tasks. The profession offers both social and financial incentives. It is important to note that practicing pharmacy will probably be a career that lasts a lifetime. Pharmacy possesses the essential characteristics of such a profession, including extensive training to learn specialized knowledge that is not available to the general public, a service orientation that puts the needs of the public before personal interests, and self-regulation as a result of specialized knowledge and skills [24].

Conclusion:

According to the pharmacy students' responses, the study shows that it is relatively easy and against national legislation to give antibiotics without a prescription in Jordan. The results of this study could serve as a blueprint for governmental health agencies to enact stringent national laws regarding the distribution of over-the-counter antibiotics to prevent the

potential difficulties that such unregulated practices might cause in the future. Additionally, pharmacy students are patient-oriented and aware of the high risk of abusing antibiotics. In order to meet the health needs of its citizens, future national policies should address this issue and its grave effects on the general health of its citizens. Furthermore, implement a clear role for the pharmacist in spreading awareness among the population regarding antibiotic-resistant.

Highlights

The highlight of the paper is the design and implementation of a questionnaire to assess the comprehension of fifth-year pharmacy students in Jordan regarding antibiotics. The questionnaire is divided into four categories: knowledge, attitude, perception, and practices towards antibiotic use. The survey revealed that a majority of pharmacists possess a clear understanding of antibiotic resistance, and most students appreciate receiving drug information from professional medical workers. The abuse of antibiotics is a problem in Jordan, with many students having seen a resistant case around them. Furthermore, the study highlights the importance of spreading awareness to the public using a reliable source of information and establishing awareness sessions on the warnings of the use of antibiotics. Finally, the study shows that the pharmacy students are aware that the unnecessary use of antibiotics will lead to resistance emerging.

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Table 1: Pharmacy students' knowledge of antibiotics

Test the Knowledge	
Question (correct response)	**Total % (n/N)**
Can antibiotics cure bacterial infections? (yes)	90.4 361/400
Can antibiotics cure viral infections? (no)	82.25 329/400
Do you think the use of antibiotics will speed up the recovery of colds, and coughs? (no)	64.5 285/400
Have you heard of antibiotic resistance? (yes)	86.30 345/400
Do you think frequent use of antibiotics will decrease the efficacy of treatment when using the antibiotic again? (yes)	68.5 274/400
Is the efficacy better if the antibiotics are newer and more costly? (no)	74 296/400

Table 2: Pharmacy students' attitude toward antibiotics.

Test the Attitude	
Question (correct response)	**Total % (n/N)**
Is bacterial antibiotic resistance a problem in Jordan? (yes)	82.20 329/400
Is the abuse of antibiotics the main cause of bacterial resistance? (yes)	76.75 307/400
Have you heard of antibiotics resistance affecting you and your family's health?	78 312/400

Table 3: Pharmacy students' behavior of antibiotics.

Test the behaviour				
Question (response)				
Do you usually use antibiotics when you have these symptoms of the respiratory tract as follows?				
Responses	**Always%**	**Never%**	**Sometimes%**	**Often%**
Coughing up yellow/green phlegm	23.28	42.46	28.76	6.80
Sore throat	26.31	34.21	35.52	3.90
Cough with fever	21.79	43.59	30.77	3.8
Obstructed nose with headache	15.05	60.27	21.92	2.7
Coughing up transparent phlegm	16.44	49.31	21.92	12.32
Cough lasting more than 2 weeks	26.67	36	29.33	8