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Self-Medication of Antibiotics among Healthcare Providers

Running Title: Antibiotic Self-Medication

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ABSTRACT: The knowledge of antibiotics (types, dosage form, dose etc), and behaviors of usage of antibiotics (frequency, side effects, resistance etc) of healthcare providers (medical practitioners, dentists, pharmacists, nurses) were assessed in this cross-sectional study. According to this study, more than half of the healthcare providers used antibiotics for themselves without getting a prescription from their colleagues, i.e., they were involved in self-medication of antibiotics. Compared to healthcare providers who kept their medications in proper storage like refrigerators, those providers who preferred to keep them in cabinets were less likely to be involved in self-medication. This study determined that it is crucial to implement educational initiatives that specifically target healthcare providers in order to deter inappropriate self-medication of drugs especially those drugs which require prescriptions from registered medical practitioners. This study findings also encourage healthcare bodies to design and implement strict guidelines to discourage self-medication of drugs among healthcare providers.

INTRODUCTION

Healthcare providers (HPs) are specified individuals which are different from the general public because they are specialized and have particular knowledge about diseases and drugs. In countries such as Nigeria, and Ethiopia 52% and 68% of HPs reportedly practice self-medication, respectively [1,2]. Another study from Russia found that more than 75% of pharmacists self-medicate using antibiotics [3]. However, knowledge regarding antibiotics seems to be inconsistent among HPs. Studies from Pakistan and Ghana found that HPs demonstrated good knowledge regarding antibiotic use, however, there was also a gap

between knowledge and practice [4,5]. In the US and Australia, HPs reported that their knowledge regarding antibiotic use was not appropriate [6,7]. In another study, knowledge of the pharmacological aspects of antibiotics and prophylactic antibiotic use among dentists was found low [8].

The term self-use is defined as the use of medical products by a user to self-treat well-known illnesses or symptoms, or the recurrent or sustained use of a medication normally prescribed by a physician for chronic or returning diseases without a physician prescription [9]. Self-use is a serious global health issue. The major issue with self-use is the lack of clinical assessment of the disorders by an experienced medical professional, which could result in unnoticed diagnosis and hinder suitable treatments [10,11].

Worldwide, self-use with antibiotics among the public is estimated to be 39%, and is reported to range between 19% and 82% in the Middle East [12,13]. Some studies found that more than 50% of antibiotics worldwide are sold without a medical prescription [14]. A few studies reported that 78% and 98% of pharmacists dispensed antibiotics without prescriptions [15,16]. One study found that more than 35% of HPs practiced self-use in another city [17]. An earlier study reported that 49% of medications were dispensed without a prescription, with antibiotics making up the greatest proportion of this [18]. Another study conducted among the public in Kuwait and the United Arab Emirates reported that 28% and 46% of people self-medicated with antibiotics, respectively [19,20].

Antibiotic resistance is a growing issue worldwide and a major threat to public health. According to the World Health Organization (WHO), infections caused by microorganisms and failure to respond to an established therapy has often led to continuously increasing healthcare costs, morbidity, and mortality. So far, only 33 out of 133 countries globally have a national action plan in place to combat antimicrobial resistance [21]. Annually, at least two million people develop bacterial infections that are resistant to antibiotics and at least 23,000 people die annually as a direct outcome of these infections in the United States [22]. The misuse of antibiotics is a key factor in the spread of antibiotic resistance, leading to a decrease in therapeutic effectiveness and increases in costs, mortality, and morbidity rates [23,24]. Self-use of antibiotics is a type of antibiotic misuse known to play a role in antibiotic resistance [25].

The knowledge, perceptions, and practices of self-use with antibiotics among HPs appear to be extensive especially after the COVID-19 pandemic. Identifying factors that influence the self-use practice of antibiotic could further help to overcome and control the misuse of antibiotics. Inadequate studies exist regarding the evaluation of self-use of antibiotic among HPs. Therefore, the aim of this study was to evaluate the knowledge, perceptions and practices toward antibiotics self-use without prescription among HPs.

MATERIALS AND METHODS

Study Setting

A cross-sectional study was conducted among HPs for 5 months.

Sampling method and study approval

The sample of this study was drawn by convenience sampling and participants from community pharmacies, hospitals, and higher healthcare teaching and practicing institutes. The study was approved by research ethics committee. All participants were required to provide consent before participating in the study.

Sample size calculation

Study sample size was calculated after adjusting potential nonresponse rate using below formula as described in various studies [26-28],

$$n = \frac{N}{1 + Nd^2}$$

and,

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$$n_n = \frac{n}{1 - d}$$

where n is "required sample size", N is "total population size", d is "error margin" (usually 0.05 is an ideal value when "confidence interval/level" is at 95%, n_n is "sample size (after consigning nonresponse rate", n is "earlier calculated sample size", and d is "nonresponse rate". After the above calculation, the final sample estimated for this study was 331 whereby we managed to obtain 425. A total of 11 participants denied to participate in the study due to various reasons, i.e., didn't want to participate, time constrain, or difficulty in recalling the information regarding antibiotics self-usage etc, hence 414 is the current sample size.

Study Design

A self-administrated questionnaire was developed after an extensive literature review on studies related to the topic. Expert validation was conducted by ten experts who assessed the relevance of the questions. A pilot study (15 subjects) was performed to ascertain the reliability and validity of the research tool before starting the study. Data from the pilot study were not included in the final results. Internal consistency was assessed using Cronbach's alpha with a value of $\alpha > 0.888$.

The questionnaire was consisted of four parts. The first part gathered demographic characteristics of the HPs. The second part evaluated HPs' knowledge regarding antibiotic self-use. The third and fourth parts measured perceptions and practices about self-use of antibiotics among HPs.

Statistical Analyses

Descriptive statistics were used to evaluate the demographic characteristics of the studied HPs. Frequencies with percentages and means with standard deviations were computed for the categorical and continuous variables, respectively. For inferential statistics, an independent sample t-test was used to compare the means, and Chi-squared and Fisher's exact tests were applied to differentiate the categorical data. A *p*-value of less than 0.05 was considered to be statistically significant. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 29.0 (Chicago, IL, USA).

RESULTS

A total of 414 HPs participated in this study comprising of 274 (66.2%) males and 140 (33.8%) females. The age ranged was 20-30 years (8%), 31–40 (28.5%), 41–50 (37%), 51–60 (19.8%) and >60 (6.8%). Among the participated HPs, 21.5% were from medicine, 23.2% from pharmacy, 17.1% from dentistry, 21.7% from nursing, and 16.4% from applied medical sciences. The majority of the HPs had 6–10 years of experience (21.7%), followed by 11–15 of experience (21.3%) and <5 years of experience (21%). A total of 249 (60.1%) of the participants reported that they had attended continuous professional education courses related to antibiotics use and resistance. These findings are presented in table 1.

Variable	Antibiotics' usage without prescription		Total	*p*-Value
	Yes	No		
	n (%)	n (%)		
Gender				
Male	114 (41.6%)	160 (58.4%)	274 (66.2%)	0.344
Female	53 (37.9%)	87 (62.1%)	140 (33.8%)	
Age (in years)				

20–30	25 (75.8%)	8 (24.2%)	33 (8%)	
31–40	51 (43.2%)	67 (56.8%)	118 (28.5%)	
41–50	41 (26.8%)	112 (73.2%)	153 (37%)	0.043
51–60	31 (37.8%)	51 (62.2%)	82 (19.8%)	
>60	13 (46.4%)	15 (53.6%)	28 (6.8%)	
Profession type				
Medicine	25 (28.1%)	64 (71.9%)	89 (21.5%)	
Pharmacy	44 (45.8%)	52 (54.2%)	96 (23.2%)	
Dentistry	29 (40.8%)	42 (59.2%)	71 (17.1%)	0.032
Nursing	38 (42.2%)	52 (57.8%)	90 (21.7%)	
Allied healthcare	47 (69.1%)	21 (30.9%)	68 (16.4%)	
Experience (years)				
<5	42 (48.3%)	45 (51.7%)	87 (21%)	
6–10	51 (56.7%)	39 (43.3%)	90 (21.7%)	
11–15	34 (38.6%)	54 (61.4%)	88 (21.3%)	0.005
16–20	31 (37.3%)	52 (62.7%)	83 (20%)	
>20	30 (45.5%)	36 (54.5%)	66 (15.9%)	
Attended continuous professional education (regarding antibiotic use and resistance courses				
Yes	135 (54.2%)	114 (45.8%)	249 (60.1%)	0.027
No	86 (52.1%)	79 (47.9%)	165 (39.9%)	

Table 1. Demographic characteristics of the studied HPs (n=414)

A total of 235 (56.8%) HPs reported that antibiotics should be used or taken in bacterial and viral infections. Approximately 154 (37.2%) responded that antibiotics should be taken for bacterial infections only. And just 6 (1.4%) of the studied HPs reported that antibiotics can be used in parasitic infections whereas a total of 19 (4.6%) said that antibiotics can be used to tear viral infections. Regarding the use of antibiotics (standard timeline), 61 (14.7%) said that antibiotics are advised to be used for 3 days, 95 (22.9%) believed they are recommended to be used for 5 days, 159 (38.4%) said antibiotics should be used for 7 days, 68 (16.4%) reported that antibiotics could be used for 10 days while 31 (7.5%) reported that they can be used until needed. These findings are presented in table 2.

Variable	Antibiotics' usage without prescription		Total	*p*-Value
	Yes	No		
	n (%)	n (%)		
Antibiotics should be used in				
Viral infection	6 (31.6%)	13 (68.4%)	19 (4.6%)	
Bacterial infection	85 (55.2%)	69 (44.8%)	154 (37.2%)	0.048
Parasitic infection	2 (33.3%)	4 (66.7%)	6 (1.4%)	
Both viral and	92 (39.1%)	143 (60.9%)	235 (56.8%)	

bacterial infections				
Antibiotic should be used				
Twice a month	11 (52.4%)	10 (47.6%)	21 (5.1%)	
Once a month	40 (48.8%)	42 (51.2%)	82 (19.8%)	
Four times a year	32 (29.1%)	78 (70.9%)	110 (26.6%)	0.026
Once a year	24 (35.3%)	44 (64.7%)	68 (16.4%)	
Once every two years	55 (41.4%)	78 (58.6%)	133 (32.1%)	
Standard timeline of antibiotic use is				
3 days	27 (44.3%)	34 (55.7%)	61 (14.7%)	
5 days	44 (46.3%)	51 (53.7%)	95 (22.9%)	
7 days	69 (43.4%)	90 (56.6%)	159 (38.4%)	0.555
10 days	47 (69.1%)	21 (30.9%)	68 (16.4%)	
Until needed	23 (74.2%)	8 (25.8%)	31 (7.5%)	
Lack of awareness regarding rules and regulations of antibiotic use is a reason for self-use				
Yes	26 (36.6%)	45 (63.4%)	71 (17.1%)	0.009
No	169 (49.3%)	174 (50.7%)	343 (82.9%)	
Antibiotics can be changed/replaced during an ongoing course of treatment				
Always	7 (8.8%)	73 (91.3%)	80 (19.3%)	
Sometimes	133 (65.8%)	69 (34.2%)	202 (48.8%)	0.762
Never	89 (67.4%)	43 (32.6%)	132 (31.9%)	
Inappropriate use of antibiotics leads to antibiotic resistance				
Yes	184 (46.6%)	211 (53.4%)	395 (95.4%)	0.025
No	12 (63.2%)	7 (36.8%)	19 (4.6%)	

Table 2. Knowledge of antibiotics' self-use

In perception about antibiotics' storage (tablet/capsule), a total of 243 (58.7%) perceived that antibiotics should be stored in a room cabinet, 149 (36%) perceived that they should be stored in a refrigerator while 22 (5.3%) perceived that antibiotics can be stored in kitchen shelf. In terms of perceptions about storage (syrup/parenteral), a total of 182 (44%) perceived that antibiotics should be stored in a room cabinet, 213 (51.4%) perceived that they should be stored in a refrigerator while 19 (4.6%) perceived that antibiotics can be stored in kitchen shelf. A total of 268 (64.7%) HPs believed that counseling is a must from a hospital or clinical pharmacist before self-usage of antibiotics. Approximately 277 (66.9%) perceived that antibiotics can be started without a prior culture and sensitivity test while 137 (33.1%) perceived that antibiotics should not be started without a prior culture and sensitivity test. These findings are presented in table 3.

Variable	**Antibiotics' usage without prescription**		**Total**	***p*-Value**
	Yes	**No**		
	n (%)	**n (%)**		
I store antibiotics (tablet/capsule) in				
Room cabinet	132 (54.3%)	111 (45.7%)	243 (58.7%)	0.019
Refrigerator	87 (58.4%)	62 (41.6%)	149 (36%)	

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Kitchen shelf	9 (40.9%)	13 (59.1%)	22 (5.3%)	
I store antibiotics (syrup/parenteral) in				
Room cabinet	85 (46.7%)	97 (53.3%)	182 (44%)	
Refrigerator	117 (54.9%)	96 (45.1%)	213 (51.4%)	0.011
Kitchen shelf	4 (21.1%)	15 (78.9%)	19 (4.6%)	
In my view a bacterial infection can be controlled without antibiotics				
Yes	34 (35.1%)	63 (64.9%)	97 (23.4%)	0.044
No	120 (37.9%)	197 (62.1%)	317 (76.6%)	
I believe counseling is needed from a clinical/hospital pharmacist about antibiotics usage				
Yes	120 (44.8%)	148 (55.2%)	268 (64.7%)	0.049
No	68 (46.6%)	78 (53.4%)	146 (35.3%)	
I believe antibiotics can be started without a culture susceptibility test				
Yes	176 (63.5%)	101 (36.5%)	277 (66.9%)	0.036
No	47 (34.3%)	90 (65.7%)	137 (33.1%)	

Table 3. Perception about antibiotic self-use

Regarding practice of self-usage of antibiotics among HPs, a total of 312 (75.4%) reported that they often use antibiotics prophylactically. A total of 134 (32.4%) HPs confirmed that they use antibiotics only after culture and sensitivity test while 280 (67.6%) said they don't. Nearly 357 (86.2%) of the HPs reported that they are fully confident while using antibiotics by themselves. Among the studied HPs, 344 (83.1%) admitted that antibiotics should only be used after a registered medical prescriber's prescription. A total of 336 (81.2%) HPs take antibiotics with water, followed by 48 (11.6%) who takes with a fruit juice, 23 (5.6%) with milk while 7 (1.7%) used to take with other liquids. These findings are presented in table 4.

Variable	**Antibiotics' usage without prescription**		**Total**	***p*-Value**
	Yes	**No**		
	n (%)	**n (%)**		
I often use antibiotics prophylactically				
Yes	201 (64.9%)	111 (35.6%)	312 (75.4%)	0.007
No	35 (34.4%)	67 (65.7%)	102 (24.6%)	
I use antibiotics after culture and sensitivity test				
Yes	52 (38.8%)	82 (61.2%)	134 (32.4%)	0.016
No	167 (59.6%)	113 (40.4%)	280 (67.6%)	
I always keep antibiotics at home for an emergency use				
Yes	222 (69.4%)	98 (30.6%)	320 (77.3%)	<0.001
No	53 (56.4%)	41 (43.6%)	94 (22.7%)	
I am confident in using antibiotics myself				
Yes	184 (51.5%)	173 (48.5%)	357 (86.2%)	<0.001

No	34 (59.4%)	23 (40.4%)	57 (13.8%)	
I feel that antibiotics should be only used after a medical prescription				
Yes	157 (45.6%)	187 (54.4%)	344 (83.1%)	0.003
No	37 (52.9%)	33 (47.1%)	70 (16.9%)	
I often take antibiotics with				
Fruit juice	23 (47.9%)	25 (52.1%)	48 (11.6%)	<0.001
Water	144 (42.9%)	192 (57.1%)	336 (81.2%)	
Milk	14 (60.9%)	9 (39.1%)	23 (5.6%)	
Other liquids	3 (42.9%)	4 (57.1%)	7 (1.7%)	

Table 4. Practice of antibiotics self-use

DISCUSSION

Many factors influence antibiotic self-usage without prescription, such as gender, age, educational level and experience. Furthermore, sociocultural, regulatory, and economic factors also play major roles [12,16,28]. In this study, majority of the studied factors like HPs age, profession type, years of experience, and attendance of continuous, were found to be significantly significant among HPs who practiced antibiotic self-use and those who did not. The majority of the previous studies evaluated knowledge and attitudes towards antibiotics and antibiotic resistance among general public and students but not among the HPs. To the best of our knowledge, very few studies evident which examined the knowledge, perceptions**,** and practices regarding antibiotic self-use among HPs. The aim of this study was to evaluate the knowledge, perceptions and practices toward antibiotics self-use without prescription among HPs.

Worldwide prevalence of antibiotic self-use among the general public is alarming and more than 40% [12]. This prevalence rate widely differs among countries and their users. According to a study done in 2018, fund that antibiotic self-use is highly prevalent in India and Nepal, with lower prevalence in Bangladesh [30]. According to their findings, the prevalence of antibiotic self-use was higher among HPs and healthcare students, whereas it was comparatively low among the general public and non-healthcare students. HPs are expected to have better knowledge and understanding of the appropriate usage of antibiotics because of their professional education and training background. However, another study reported in 2013 that low level of knowledge of antibiotics usage and resistance was present among dentists [8].

Our study findings represented that 167 (40.3%) of HPs used antibiotics without a prescription, and 247 (59.7%) used with a prescription. Among the HPs which used antibiotics without prescription were 71.9% from medical, 54.2% pharmacists, 59.2% dentists, 57.8% nurses, and 30.9% from allied medical professions like physiotherapy etc. Our study findings corroborate with the results of previous studies, which reported higher percentages (up to 50%) of antibiotics usage without prescription among HPs. These countries included Russia, Ethiopia, and Nigeria [1,2,16]. However, our study results are opposite to a study conducted in the US which reported a lower percentage (8%) of antibiotics self-usage among physicians in the US [31]. In our study, a statistically significant difference was observed between the age (p = 0.043), profession type (p = 0.032), years of experience (p = 0.005), and the attendance of continuous professional education. However, in gender variable, there was a statistically non-significant association observed among HPs regarding self-use of antibiotics without a prescription.

In our study, it was observed that 82.9% of HPs were aware about the rules and regulations of apt use of antibiotics and just 17.1% were not very sure about the current rules and regulations of apt antibiotic usage to treat various infections. The majority of the HPs reported using antibiotics 'until needed' (32.1%), followed by four times a year (26.6%), followed by once a month (19.8%), and only 16.4% reported using antibiotics once a year. Most of the participants (48.8%) believed that an ongoing antibiotics treatment course can be changed and replaced with another antibiotics. In literature, use of antibiotics when they were not necessary and not completing the full course of an antibiotic type are found to be the main causes of antibiotic resistance among the individuals [3-8]. In our study, nearly 95.4% of the studied HPs were familiar with the concept that inappropriate use of antibiotics leads to antibiotic resistance. These findings highlight the knowledge of antibiotic self-use

among the studied HPs. A statistically significant difference was found between the self-use of antibiotics and the knowledge of antibiotics usage duration ($p = 0.026$). Moreover, among the reasons why HPs self-use the antibiotics, lack of awareness regarding the rules and regulations of apt use of antibiotics was also found to be statistically significantly different ($p = 0.009$). A statistically significant difference was also observed regarding knowledge of inapt usage of antibiotics leads to antibiotic resistance ($p = 0.009$) among HPs.

Perceptions of antibiotic self-use were found to be influenced by the current knowledge of antibiotics among HPs. According to our study results, in perception, all of the studied variables were found to be statistically significantly different among HPs regarding their self-use of antibiotics with prescriptions and without prescriptions i.e., storage of antibiotics (tablet and capsules) ($p = 0.019$), storage of antibiotics (syrup and injectables) ($p = 0.011$), bacterial infection can be controlled without antibiotics ($p = 0.044$), counseling needed from a clinical/hospital pharmacist about antibiotics usage ($p = 0.049$) and antibiotics can be started without a culture susceptibility test ($p = 0.036$).

However, some studies reported that good knowledge is not always associated with good antibiotic practice among HPs [4,5]. According to our study results, in practice, all of the studied variables were found to be statistically significantly different among two groups of HPs i.e. self-use of antibiotics with prescriptions and without prescriptions i.e., using antibiotics prophylactically ($p = 0.007$), using antibiotics after culture and sensitivity test ($p = 0.016$), keeping antibiotics at home for an emergency use ($p <0.001$), confidence in self-use of antibiotics ($p <0.001$), using antibiotics after a medical prescription ($p = 0.003$), and taking antibiotics with fruit juices, water, mil or other liquids ($p <0.001$).

Even though HPs reported being aware of how to access healthcare services and having appropriate knowledge about antibiotics, a high percentage of them favored using antibiotics without a medical prescription. This study revealed that HPs' beliefs regarding the side effects of certain antibiotics was a significant factor. Consequently, most of the HPs used these antibiotics without prescription, though some of them were medical practitioners. However, choosing antibiotic medications solely based on beliefs or experience is not a good professional approach regarding safety. Issues associated with self-use of antibiotics without prescription include the lack of appropriate clinical assessment or diagnosis, as well as the potential of not choosing proper medications for a particular disease [32].

Our results showed that allied healthcare professionals were significantly less likely to self-treat with antibiotics compared to other HPs whereas it was more common among nurses. These results oppose a previous investigation by Barros and colleagues (2009), who showed that antibiotic self-use was not common among nurses [33]. This gap between different HPs and nurses could be due to efforts made by different nursing organizations in combating the use of medications without prescriptions [34]. Other healthcare sectors could adapt similar strategies to increase awareness and prevent self-use of antibiotics without a prescription among nurses.

The knowledge domain further elaborated the study model in terms of explaining the factors related to the self-use of antibiotics without prescription among HPs. Coupling antibiotic resistance with either the use of inapt antibiotics or apt antibiotics but without a registered medical prescription and a lack of adherence to antibiotics' prescribing guidelines further lead to improper antibiotic usage among HPs. Multiple data sources show that precise and up-to-date knowledge about antibiotics usage, resistance pattern and continuous professional education about antibiotics plays a key role in a safer antibiotic utilization, particularly in developing countries [35,36]. In this regard, many countries have already initiated different healthcare campaigns by designing and implementing more restrictive antibiotics prescribing guidelines, and practicing antimicrobial stewardship programs among the HPs, aiming for safer and effective antibiotics use [37].

This was a novel comprehensive study investigating the knowledge, perceptions, and practices of HPs regarding antibiotic self-use without prescription. As this was a cross-sectional study with a self-administered measure to determine knowledge, perceptions, and practices of HPs towards antibiotic self-use, there was a greater likelihood of recall bias in some of HPs' responses. Further, since the instrument was self-administered, some respondents may have overlooked questions, or they provided inappropriate answers, or skipped some parts of the questions. This would mean that the responses provided might not have been true and accurate which is another limitation of this study.

CONCLUSION

This study concludes that educational interventions regarding antibiotics usage and resistance, especially among HPs, are of extreme importance. Improvement in the overall quality of healthcare facilities and continuous professional education about appropriate antibiotic self-use along with strict law enforcement and a rigid quality control should be encouraged, to discourage inappropriate self-use of antibiotics without prescription among HPs. Pharmacists, who are drug experts, should also be involved, encouraged and educated to not to dispense antibiotics to anyone without appropriate, authorized and registered medical prescriptions, even if they are being dispensed to the HPs.

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