

A cross-sectional study on knowledge, attitude and practices of medical doctors towards antibiotic prescribing patterns and resistance in Khyber Pakhtun Khawah, Pakistan

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ARTICLE INFO

Article history:

Received on: 12/07/2017

Accepted on: 08/11/2017

Available online: 30/12/2017

Key words:

Antibiotic resistance;
Rational antibiotic use;
Physicians' knowledge;
Pakistan.

ABSTRACT

Irrational prescribing and resistance to antibiotics are major health concerns globally. The aim of this study was to assess the physicians' knowledge, attitude and practice about antibiotic prescribing and resistance in Khyber Pakhtun Khawah (KPK), Pakistan. A cross-sectional, descriptive study was conducted using a pre-validated self-administered questionnaire. Statistical Package for Social Sciences (SPSS®) version 23 was employed to analyze the data. A total of 320 medical practitioners participated with a response rate of 61.5%. Participants generally had a good knowledge about antibiotic use. However, some flaws were observed in their practice. The Internet (96%), antibiotic guidelines (92%) and medical representatives (85.9%) were reported to be the most useful sources of information. More than 70% of the respondents cited patient demand as one of the major reasons for antibiotic overuse. Antibiotic resistance was reported to be due to the failure to complete the antibiotic course by 94.1% of the respondents. The majority of the participants never had a training on the rational use of antibiotics and were in a favour of attending such training if offered. The study concluded that there is a dynamic need of training initiatives for improving antibiotics prescribing behaviour of general practitioners through the development of local guidelines and continuous education of general practitioners to promote rational antibiotic prescribing.

INTRODUCTION

Irrational use of antibiotics is a global phenomenon. More than 50% of all antibiotics are prescribed, sold or dispensed inappropriately, while 50% of the patients are not taking antibiotics correctly (WHO, 2004). Some of the factors affecting this irrational use include socio-economic status, physicians' knowledge and training, patient load, diagnostic ambiguity, availability of treatment guidelines and pharmaceutical marketing (Barden *et al.*, 1998; Andrajati *et al.*, 2017). The potential dangers associated with inappropriate use of antibiotics

are the dissemination of resistant micro-organisms, and significant adverse effects such as, increase in the duration of hospitalization, increase in the hazard of drug toxicity, and a significant increment in the cost (Buke *et al.*, 2005). Community-acquired antibiotic resistance is on the rise because of the general suboptimal use of antimicrobials in the casualty settings (Byarugaba, 2004). In developing countries, one of the most important factors affecting antimicrobial resistance is the lack of proper training of healthcare providers regarding proper antimicrobial use and infectious disease clinical diagnosis (WHO, 2001). Other reasons include the incomplete course of treatment and self-medication (Amabile-Cuevas, 2010a; Rafeeqe, 2016). Medical practitioners play an important role in consumption and control of antibiotics. This requires informing practitioners about how to avoid antibiotic resistance and encourage them to take steps to ensure patient wellbeing (Giblin *et al.*, 2004).

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Literature from various countries has shown that over the years, excessive antibiotic prescribing resulted in antibiotic resistance which requires improvement, yet the ideal methods to deal with this problem remain vague (Amabile-Cuevas, 2010a; WHO 2012; Thriemer *et al.*, 2013; Sebsibie and Gultie, 2014; Ahmad *et al.*, 2015). Such type of improvement always requires vital changes in medical doctor's behaviour through their awareness and perceptions regarding antibiotic resistance (Wester *et al.*, 2002; Giblin *et al.*, 2004; Srinivasan *et al.*, 2004). Medical doctors may modify their practice only when their attitudes, skills, beliefs and knowledge are integrated with each other potentially resulting in a decrease in antibiotic resistance (Wester *et al.*, 2002; Giblin *et al.*, 2004). The first step to achieve this is administering KAP surveys which are used to evaluate knowledge (K), attitudes (A) and practices (P) of medical practitioners (Thriemer *et al.*, 2013). The bacterial resistance to available antibiotics is a serious problem in Pakistan. A sensitivity analysis may help in preventing unnecessary antibiotic prescription thereby decreasing the chances of resistance (CDC, 2014). However, the majority of antibiotics are being prescribed without culture sensitivity testing in Pakistan as reported in a study conducted in Southern Punjab region of Pakistan (Atif *et al.*, 2017). Hence, there is a need to evaluate the current prescribing practices of antibiotics among the medical doctors and updating their knowledge to eradicate the side effects caused by prescribing wrong antibiotics against specific microbial infections. The purpose of this study is to assess the physicians' knowledge, attitude and practice about patterns of antibiotic prescribing and its resistance in Khyber Pakhtun Khawah (KPK), one of the four administrative provinces of Pakistan, in order to improve the clinical practice for the most common infections.

MATERIALS AND METHODS

Study Design and Setting

The study used a quantitative descriptive approach with a purposeful sampling of medical doctors with diverse degree of work record. Medical practitioners' knowledge, attitude and practice of antibiotic prescribing and its resistance was assessed. Data was collected from different administrative divisions of Khyber Pakhtun Khawah (KPK) namely Peshawar, Hazara, Mardan, Dera Ismail Khan (D. I. Khan), Bannu, Kohat and Malakand. Medical doctors were visited at health centers and hospitals.

Study instrument

A pre-validated 35-item questionnaire was used as the instrument. Influences to develop the questionnaire were drawn from an earlier study (Thriemer *et al.*, 2013). The face and content validity of the instrument was established by four experienced medical professionals. The self-administered questionnaire was piloted on 20 individuals meeting the inclusion criteria and the contents were refined based on the findings of the pilot study. The internal consistency was determined through the Chronbach's Alpha ($=0.64$). The final questionnaire consisted of 35 questions which were divided into four sections. Questions about

demographic characteristics were asked at the beginning. Four questions in Section A addressed the work experience and prescription patterns. Next nine questions were meant to assess knowledge of the current scope of antibiotics (Section B) while twelve questions in Section C recorded the attitude toward antibiotic prescribing. Finally, the practice of antibiotic prescribing was assessed through ten questions in Section D.

Study Sample and Data Collection

Data were collected from September 2015 to January 2016. The sample size was calculated using Raosoft[®], a sample size calculator. According to Pakistan Medical and Dental Council (PMDC) statistics, total 17746 medical doctors were registered in KPK during June 2015 (PMDC, 2015). For calculation of sample size, 5% margin of error and 95% confidence interval was selected. The calculated sample size was 267. Both male and female medical doctors were included in the study while medical students and dental physicians were excluded. The questionnaire was individually handed over to the medical doctors in selected administrative divisions of KPK. Before completion of the questionnaire, the respondents were explained about the aim and nature of the study and verbal consent was taken. The questionnaires were immediately collected after being filled in by the respondents. No incentives were given to the respondents.

Ethical Considerations

The study was approved by the Research Ethics Committee of COMSATS Institute of Information Technology, Abbottabad, Pakistan. Prescribers were clearly informed about the study and were clearly guaranteed about the confidentiality of their answers. All the participations were voluntary.

Data Analysis and Presentation

The data were analyzed using descriptive statistics in SPSS[®] version 23. Findings were presented as numbers and percentages in the form of tables and bar-charts.

RESULTS

Demographic and Practice Characteristics

A total of 520 physicians in KPK were approached and only 320 respondents took part in the study with a response rate of 61.5%. Among the participants, 83 were women and 237 were men. Most of the participants (59.47%) were above 30 years old. Other demographic and practice characteristics are listed in Table 1.

Table 1: Demographic characteristics and general information of prescribers in KPK (N=320).

Demographic variables	n (%)
Gender:	
Female	83(25.9)
Male	237 (74.1)
Age:	
<30	129 (40.3)
>30	191 (59.7)

KPK Divisions:	57 (17.8)
Peshawar	104 (32.5)
Hazara	35 (10.9)
Mardan	52 (16.3)
D. I. Khan	23 (7.2)
Bannu	20 (6.3)
Kohat	29 (9.1)
Malakand	
How many years have you been working after you graduated from medical school?	33 (10.3)
I am a trainee in medicine	77 (24.1)
Less than one year	89 (27.8)
1- 3 years	67 (20.9)
4 – 6 years	54 (16.9)
7 years and more	
To whom do you prescribe antibiotics?	53 (16.6)
Patients at out-patient department	61 (19.1)
Hospitalized patients	206 (64.4)
Both	
How often do you prescribe antibiotics?	108 (33.8)
More than once daily	47 (14.7)
Once daily	107 (33.4)
3 – 5 times a week	19 (5.9)
1 – 2 times a week	39 (12.9)
Less than once a week	
How confident are you about your knowledge of antibiotics?	69 (21.6)
Very confident	199 (62.2)
Confident	22 (6.9)
Neutral (I have no idea)	25 (7.8)
A bit confident	05 (1.6)
Not at all confident	

Knowledge on Antibiotics

Most of the respondents (94.7%) agreed that antibiotic resistance is an important problem worldwide and especially in Pakistan. About 90% of the respondents agreed that antibiotics are overused in the community with 39.3% who strongly agreed

that it is a major problem in their own daily practice. More than half (55%) of the respondents disagreed that antibiotics can be used to treat viral infections and 42.1% of the respondent also disagreed that antibiotics will speed up the recovery of cold and similar conditions. The majority (63.7%) agreed that antibiotics are available on medical stores like non-prescription medicines and 43.1% of the respondents agreed that efficacy will be better if the antibiotics are newer and the price is higher (Figure 1).

Attitude towards Antibiotic Prescribing

The majority (95%) of the respondents strongly agreed that antibiotic resistance rate is important to know and 88.7% strongly agreed that cultural sensitivity test is also important before prescribing. However, this can only be done by the support of microbiology laboratory. According to our results, there was no single doctor who performed the culture sensitivity test. The findings are summarized in Figure 2. The majority of the respondents from all divisions admitted that it is important to know the resistance rate of bacteria in local settings and cultural sensitivity test is important for prescribing. Peshawar and Hazara division respondents disagreed that selection of antibiotics is influenced by the availability of antibiotics. Respondents from all divisions agreed that patients demand for antibiotics is the major reason that contributes toward the abuse of current antibiotics. Among different divisions, only the majority of Hazara division respondents disagreed that antibiotics that are available locally are of bad quality and for antibiotics selection, local guidelines are more useful than international guidelines. All respondents were interested in a training program to be initiated.

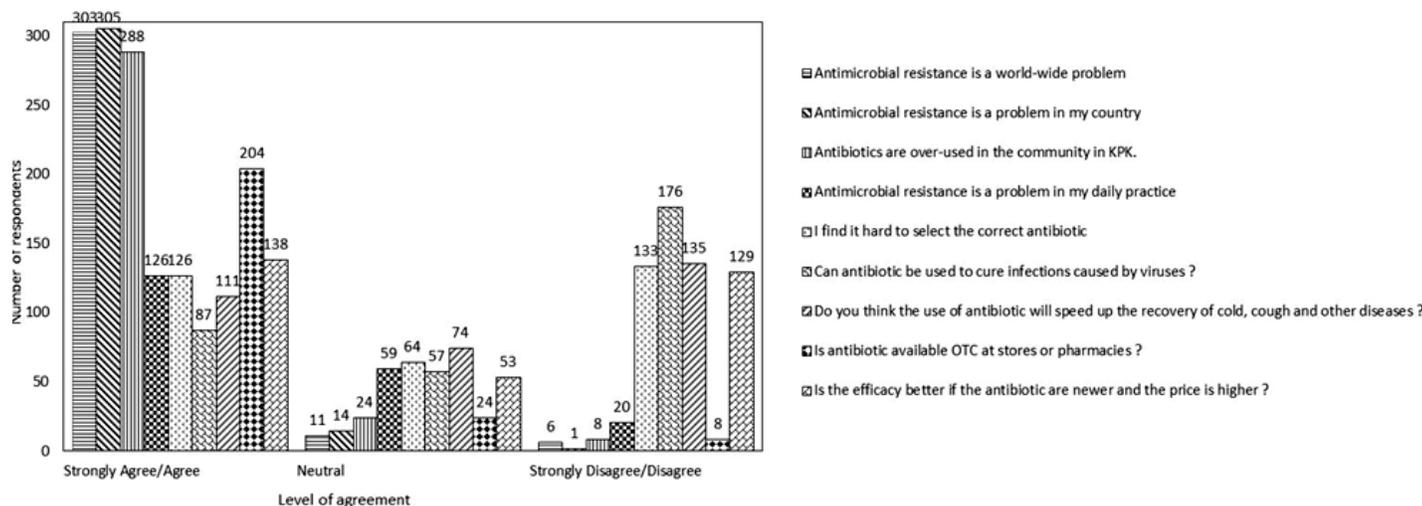


Fig. 1: Knowledge of antibiotic prescribers (N = 320).

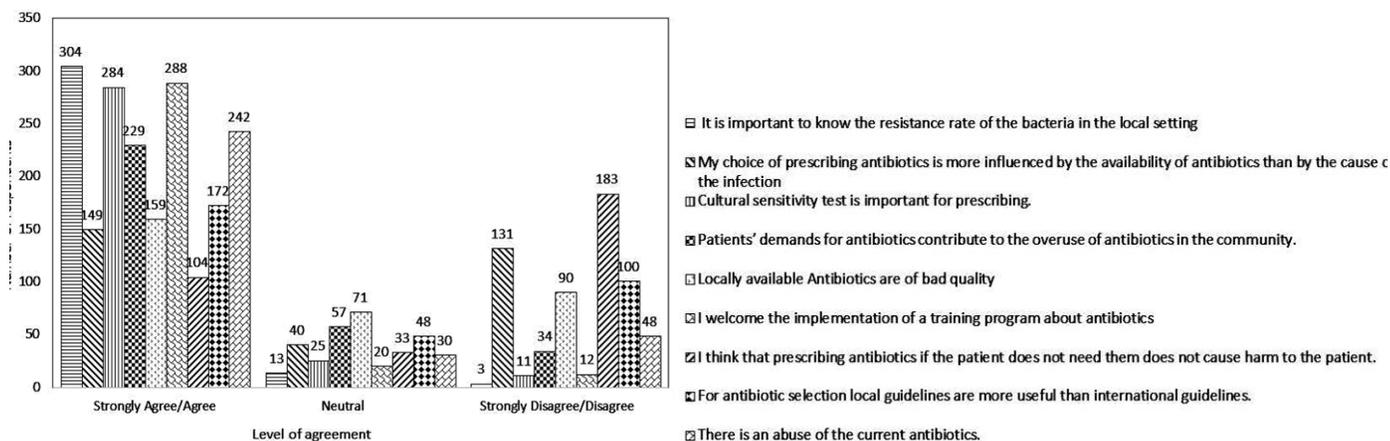


Fig. 2: Attitude of antibiotic prescribers (N = 320).

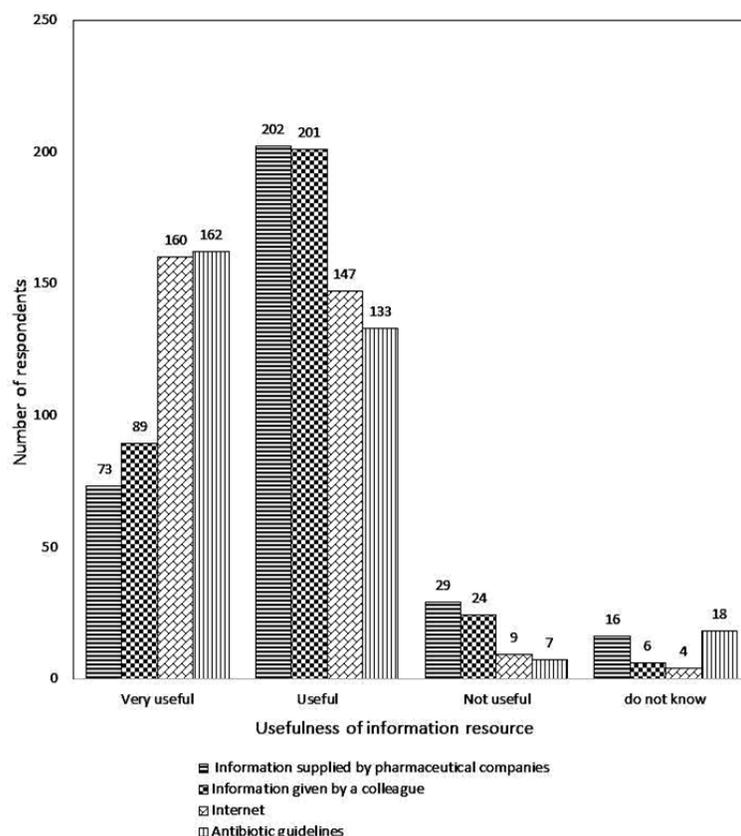


Fig. 3: Sources of Information's for antibiotic prescribing.

Antibiotic Prescribing Practices

Table 2 shows the overall response about prescribing practices in different divisions of KPK. The majority (93%) of the respondents agreed that no antibiotic treatment is required in case of diarrhea and only 19% were of the same view for rhinitis. Less than 24% of the respondents replied correctly for parenteral administration of aminoglycosides once daily and less than 40% replied correctly that no antibiotics are used if the patient is moderately febrile. Figure 3 shows the overall response about sources of information for antibiotic prescribers with internet

reported to be the most useful and accessible source (96%) followed by antibiotic guidelines (92%) and pharmaceutical companies (85.9%).

About 70% of the doctors did not receive any training about antibiotics in the past. Figure 4 shows the overall response about contributing factors to antibiotic resistance in KPK. Nearly 94.1% of the respondents thought that patient does not finish his or her treatment followed by 79.7% who admitted that antibiotics are not prescribed according to the bacterium that causes the infection.

Table 2: Antibiotic prescribing practices.

Overall correct Response (Percentage)	Divisional Correct Response							Total
	Peshawar	Hazara	Malakand	D.I.Khan	Banu	Kohat	Mardan	
A 4-year-old child had diarrhea for 4 days (3 stools daily). She had no fever during the past days nor at consultation. What is your treatment choice?								
Amoxicillin orally								
Trimethoprim/Sulphamethoxazole								
Amoxicillin/Clavulanic acid	54/57	95/104	33/35	50/52	23/23	20/20	25/29	300/320
No antibiotic, just oral Rehydration*	94.7%	91.3%	94.2%	96.1%	100%	100%	86.2%	93.7%
A 6-year-old child has a fever (38°C), nasal discharge and a painful throat for two days. A visual inspection, the throat is reddish. What is your treatment choice?								
Trimethoprim/Sulphamethoxazole								
Amoxicillin orally								
Amoxicillin/Clavulanic acid	10/57	11/104	11/35	5/52	8/23	6/20	10/29	61/320
No antibiotic*	17.5%	10.5%	31.4%	9.6%	34.7%	30%	34.4%	19.1%
You have seen two patients with impaired renal function. Patient A is a 68-year-old male with cellulitis in the lower limb. He is administered Clindamycin. Patient B is a 64-year-old woman with diabetes who received Empirically treatment for sepsis with Ceftriaxone. In which case you will need to adjust the antibiotic dose?								
Patient A								
Patient B								
Patient A and B								
Neither patient A nor patient B*	2/57	8/104	1/35	0/52	4/23	1/20	4/29	20/320
	3.5%	7.6%	2.8%	0%	17.3%	5%	13.7%	6.3%
Which one of the following antibiotics may be safely given during the first trimester of pregnancy?								
Ciprofloxacin								
Gentamicin	51/57	94/104	19/35	52/52	19/23	11/20	19/29	265/320
Amoxicillin*	89.4%	90.3%	54.2%	100%	82.6%	55%	65.5%	82.8%
Which of the following antibiotics has the best activity against anaerobes?								
Ciprofloxacin								
Trimethoprim/Sulphamethoxazole								
Metronidazole*	47/57	90/104	26/35	48/52	19/23	14/20	22/29	266/320
	82.4%	86.5%	74.2%	92.3%	82.6%	70%	75.8%	83.1%
Methicillin resistant - Staphylococcus aureus is susceptible to:								
Amoxicillin/ Clavulanic acid								
Cefotaxime								
Ceftriaxone								
None of these antibiotics*	43/57	66/104	10/35	24/52	3/23	6/20	7/29	159/320
	75.4%	63.4%	28.5%	46.1%	13%	30%	24.1%	49.7%
Which of the following antibiotic most effectively crosses the blood-brain barrier?								
Clindamycin								
Vancomycin	43/57	51/104	20/35	34/52	6/23	17/20	19/29	190/320
Ceftriaxone*	75.4%	49%	57.1%	65.3%	26%	85%	65.5%	9.4%
Aminoglycoside antibiotics such as gentamicin are most active when they are administered as follows:								
Orally, three times daily								
Parenterally, three times daily								
Parenteral, once daily*	18/57	25/104	7/35	10/52	3/23	4/20	9/29	76/320
	31.5%	24%	20%	19.2%	13%	20%	31%	23.8%
In 22 years old Patient having a fever, You may prescribe antibiotic when his body temperature reaches								
>37°C, (98.6°F)								
>37.5C, (99.5°F)								
>38C, (100.4°F)								
>38.5C,(101.3°F)	22/57	15/104	7/35	41/52	14/23	11/20	17/29	127/320
No antibiotics*	38.5%	14.4%	20%	78.8%	60.8%	55%	58.6%	39.7%

*Correct answer

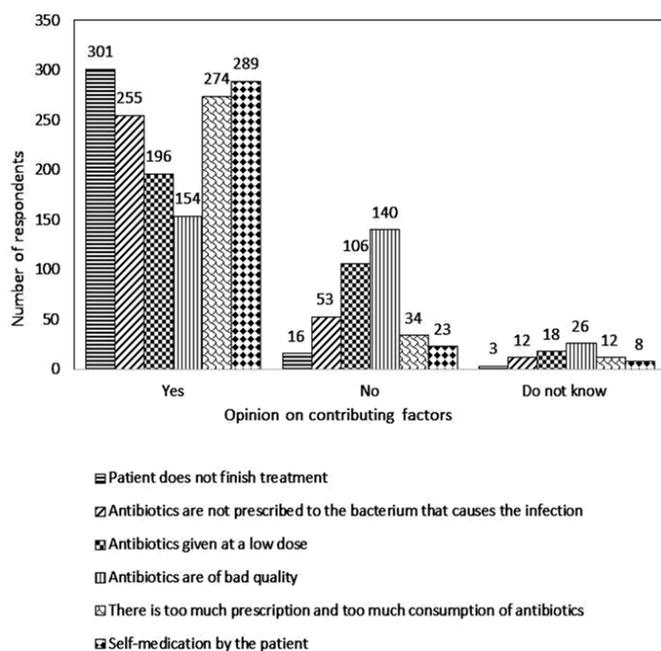


Fig. 4: Contributing factors of antibiotic resistance.

DISCUSSION

This study provides a detailed information of knowledge and practices regarding antibiotic use among registered medical practitioners practicing in KPK, Pakistan. Due to male dominance (more than 65% of the registered medical practitioners were men) (PMDC, 2015), more data was obtained from male practitioners. Antibiotics in Pakistan is reportedly sold as OTC (over the counter) medications in pharmacies. This has not been reported first time in this study but a number of previous studies have documented the same (Anwar *et al.*, 2015; Haseeb and Bilal, 2016; Ashraf *et al.*, 2017). A previous study in India reported that 75% of pharmacy clients take their decision of antibiotics purchasing based on the experiences of their peers with antibiotics prescribed by a senior medical doctor (Dua *et al.*, 1994; Livorsi *et al.*, 2015). Another issue worth mentioning is that the physicians instead of using narrow or single spectrum antibiotics prefer wide spectrum ones, even if these antibiotics have no indications (Khan *et al.*, 2013). The government encourages the use of generic medicines for prescriptions and procurements, however; the negative perceptions among the doctors, pharmacists and even the general public about the quality and efficiency of generics as reported in a systematic review, might be the reason that discourages the practitioners from prescribing the generics (Colgan *et al.*, 2015). Similarly, there have been concerns over the generic medication ingredients coming from possible sources with less oversight, such as India and China (Chu and Hamp, 2012). As reported in a 2005 study, 20% of generic ciprofloxacin eye drops purchased in India were of low potency, and some preparations of the antibiotic content were low enough to negatively affect the treatment outcomes (Weir *et al.*, 2005).

In our study none of the respondents performed or advised for the culture sensitivity test which is consistent with earlier studies conducted in Pakistan whereby culture sensitivity testing was non-existent (Atif *et al.*, 2017) and in Bangladesh reporting that 90% of the antibiotics were prescribed without laboratory findings (García *et al.*, 2011). This practice of not conducting culture sensitivity test may exacerbate the problem of antibiotic resistance in Pakistan as the sensitivity analysis is one of the various means to minimize the occurrence of antibiotic resistance and promoting rational prescription of antibiotics (CDC, 2014). A report from Trinidad suggested that doctors did not usually demand laboratory analysis as they felt that culture sensitivity tests are useless and time-consuming (Mohan *et al.*, 2004). Likewise, in Pakistan, the absence of laboratory services was found to be one of the major reasons of excessive antimicrobial prescribing (Nizami *et al.*, 1996).

Demand and pressure from the patients were reported to be one of the predominant factors driving the irrational prescribing of antibiotics which is consistent with the findings from low and middle-income countries. For example, a survey of pediatricians and patients' caregivers in Venezuela discovered that approximately 87% of the physicians felt pressured by patients in prescribing antibiotics; half of the patients said that they had demanded antibiotics and one-quarter admitted that they had attained a prescription (Britten and Ukoumunne, 1997). Many studies conducted in other developing countries such as the one conducted in Tamil Nadu State of India revealed that antibiotics are often overprescribed and misused by health providers and one of the important reasons behind this was patient desires and satisfaction issues that lead to inappropriate antibiotic use (Fluit *et al.*, 2001; Madani *et al.*, 2001; Smith and Coast, 2002; Pedersen *et al.*, 2007; Shahid *et al.*, 2017)

Similarly, among the reasons causing antibiotic resistance, patient-related problems (self-medication) existed more often. A number of recent studies conducted in Pakistan have presented the similar findings and the common reasons for such practices included low socio-economic status and level of education, previous experience, and ease of purchasing antibiotics from pharmacies without prescription (Naveed *et al.*, 2015; Hameed *et al.*, 2016; Hanif *et al.*, 2016). This is also consistent with a French study which stated that parents generally preferred self-medication for mild pathologies in their children (Escourrou *et al.*, 2010). A study in China showed that children had received self-medication by 51% of the parents (Bi *et al.*, 2000). Many studies in developing countries presented that antibiotics are used most commonly in everyday practice, whereas the most common symptom of the use of antibiotics was fever. Management of fever with antibiotics without microbiological investigations has been considered as a primary factor of irrational drug use in the developing countries (Istúriz and Carbon, 2000). Similarly, More than half of the respondents agreed that if antibiotics are administered at lower than the required doses that may cause the antibiotic resistance which is in line with the findings from Congo (Thriemer *et al.*, 2013). Such findings suggest that sincere

measures need to be taken to educate people on the appropriate use of antibiotics.

A large number of the respondents stated that they referred to the information provided by pharmaceutical companies. A number of earlier studies concluded that advertising activities promoted the random supply of antimicrobial agents in some cultures (Kamat *et al.*, 1997; Prats *et al.*, 2000; Wolfers, 1987). Numerous studies have reported that the marketing tactics of pharmaceutical industries play an important role in increasing the prescribing and sale of certain drugs (Wolfers, 1987; Haak, 1988; van Staa, 1993; Ijoma *et al.*, 2010; Workneh *et al.*, 2016). A regression analysis conducted on data from selected cities of Pakistan exposed that the promotional tools of pharmaceutical companies had a substantial impact on physicians' prescribing practices (Ali *et al.*, 2015). The fair information available about antibiotics is a requirement intended for suitable antibiotic suggesting (World Health Organization, 2012). Information from pharmaceutical industries was graded highest inaccessibility. Although lower most valued for effectiveness, this approves the prominent part of pharmaceutical companies to affect the prescribing practices in developing countries (Amabile-Cuevas, 2010b).

The finding that the majority of the respondents had not received any formal training on antibiotic prescribing describes the mismatch between knowledge and practice as reported in this study. This, coupled with the willingness of the respondents to attend such training if offered suggests that as a part of Continuing Professional Development (CPD), workshops or seminars on how to prescribe antibiotics should be organized on a routine basis by the health department.

The importance of treatment guidelines cannot be denied as a good number of respondents agreed that antibiotic guidelines must be followed for antibiotic prescribing. This relates to the surveys from other countries in which the antibiotic guidelines ranked high by the participants with a demand to develop local antibiotic guidelines (García *et al.*, 2011; Guerra *et al.*, 2007). Similarly, when prescribing antibiotics, there was a little tendency to consult colleagues (Bennish and Khan, 2010; Srinivasan *et al.*, 2004). Today, several countries like Netherlands and Britain are concentrating on public education so as to promote the rational use of antibiotics in the local community in order to minimize the development of resistance to antibiotics (Davey *et al.*, 2002; Stille *et al.*, 2008). Although it has been proposed that public education alone may not improve the tendency to abuse and misuse antibiotics in the society (McNulty *et al.*, 2007), other researchers argue that providing perfect antibiotic guidelines to medical prescribers may deliver a more effective and quicker route to rational use of antibiotics, ultimately reversing the current trend (Amabile-Cuevas, 2010a; Metlay *et al.*, 2002).

The study has important limitations. Firstly, the findings of this study cannot be generalized for the whole country as the study was conducted in one province. Furthermore, in recent years, KPK government has made significant improvements in the health sector which further limits the generalizability of the findings and

suggests the need for conducting similar studies in other provinces. Secondly, there might be variations among the study participants in terms of their experience with antibiotics based on the type of speciality they were working in. However, the aim of the study was to draw an overall picture of practitioners experience with antibiotics and we did not categorize our participants based on the clinical speciality. Thirdly, the ingrained limitations of survey research such as recall bias, potentially dishonest answers from the respondents and systematic and random errors were unavoidable. Nevertheless, survey research is a cost-effective and efficient mean of collecting information about a population.

The study has some noteworthy implications on policy and practice. The findings indicate that there is a dire need to provide training to the prescribers and educate the masses to ensure the rational use of antibiotics. On the policy front, more stringent strategy is required to minimize the sale of antibiotics as OTC medications so as to minimize the occurrence of antimicrobial resistance. Further work to recognize and appreciate the full degree of antibiotic usage and irrational prescribing in other provinces and rural areas of the country is warranted.

CONCLUSION

The study concludes that the practitioners generally had a good level of knowledge about antibiotics. However, some shortcomings were observed in the prescribing pattern. Culture sensitivity test, though recognized by the respondents as an important strategy to minimize the chances of resistance, was not a common practice. The availability of antibiotics without prescription and failure of the patients to complete their antibiotic course were regarded as the most common contributing factors to antibiotic resistance. The practitioners generally relied on information from internet, treatment guidelines and pharmaceutical companies, however; no formal training sessions were attended by the majority of the prescribers. Therefore, the study highlights the need to regulate the prescribing of antibiotic and training initiatives for improving antibiotics prescribing behavior of medical doctors in Pakistan. Finally, local guidelines and continuous education of general health professionals would be an essential step to promote rational use of antibiotics.

Financial support and sponsorship: Nil.

Conflict of Interests: There are no conflicts of interest.

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How to cite this article:

Faizullah M, Rahman N, Umar MI, Anwar M, Sarfraz M. A cross-sectional study on knowledge, attitude and practices of medical doctors towards antibiotic prescribing patterns and resistance in Khyber Pakhtun Khawah, Pakistan. *J App Pharm Sci*, 2017; 7 (12): 038-046.