

Knowledge, attitude, and practices of health-care providers toward antibiotic prescribing, antibiotic resistance, and multidrug-resistant tuberculosis

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Abstract

Introduction: Antibiotic resistance (ABR) is a growing public health problem and is a subject of international concern. It poses a serious threat to health and health-care systems in both developed and developing countries. The problem is more confounding with tuberculosis (TB), and drug resistance in TB has threatened the progress made in TB care and control worldwide. The aim of this study was to understand the knowledge, attitude, and practices of health-care providers (HCPs) toward antibiotics, antibiotic prescribing, ABR, and multidrug-resistant TB (MDR-TB).

Materials and Methods: A total of 125 participants were included in this cross-sectional, questionnaire-based survey conducted in tertiary care teaching hospitals of the Delhi-NCR region. A five-point Likert scale, whose responses ranged from “strongly agree” to “do not know,” was used to record the responses from participants.

Results: Among the 125 HCPs who participated in the survey, the response rate was 100%. Around 94.4% of the respondents agreed that ABR is an important and a serious public health issue. More than 80% of the respondents strongly agreed that over-the-counter sale and/or dispensing antibiotics without prescription should be controlled. About 86.4% of the participants agreed that MDR-TB is a growing problem and 59.2% strongly agreed that indiscriminate use of anti-TB drugs could be a major causative factor. Almost 85.6% of the participants agreed that a proper diagnosis should be ensured before treating the TB cases.

Conclusions: HCPs had a good knowledge of antibiotics and the association of its misuse or overuse with increasing ABR. Educational and persuasive measures are certainly needed, but the use of restrictive and organizational measures appears mandatory if the misuse of antibiotics is to be decreased in the near future. A stringent assessment of the impact of implemented measures seems essential to better guide antibiotic stewardship in our country.

Keywords: Antibiotic stewardship, multidrug resistance, *Mycobacterium tuberculosis*, rifampicin, extensively drug-resistant tuberculosis

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INTRODUCTION

Infectious diseases, the leading cause of morbidity and mortality once, turned into more manageable health problems after the advent of antibiotics.^[1,2] With time, the advances in the scientific and medical technology resulted in the development of various new antibiotics which are now commonly prescribed to patients. However, greater accessibility resulted in irrational and excessive use leading to antibiotic resistance (ABR).^[3-5]

ABR is a growing public health problem and is a subject of international concern. It poses a serious threat to health and health-care systems in both developed and developing countries.^[6] High rates of antibiotic use in hospitals, community, agriculture and veterinary practices create a selective pressure and the resistant strains sustain which eventually forces a shift toward broad-spectrum antibiotics.^[7] Moreover, in low- and middle-income countries, the high burden of infectious diseases and the unregulated access to antibiotics results in the emergence of ABR.^[6] Epidemiological studies suggest that there is a clear association between misuse or overuse of antibiotics and the growing ABR.^[8] The rational use of antibiotics is one of the most crucial steps to slow down the development and spread of resistant strains worldwide.^[9] Various factors associated with inappropriate use of antibiotics are enumerated in Table 1.

Drug resistance in tuberculosis (TB) is another major public health problem that has threatened the progress made in TB care and control worldwide. Global efforts to control the TB pandemic have been undermined by the emergence and dissemination of strains resistant to the first-line anti-TB drugs. Strains resistant to at least isoniazid and rifampicin, the two most efficacious TB drugs, are termed multidrug resistant (MDR).^[10] The recent emergence of extensively drug-resistant TB (XDR-TB) defined as MDR-TB strains with resistance to a fluoroquinolone and to at least one injectable second-line drug has further deteriorated the problem.^[10,11] The treatment of MDR-TB is difficult, as

it requires second-line drugs, some of which are only injectables, are less efficacious, more toxic, and more expensive than the first-line agents.^[12]

A better understanding of the determinants of antibiotic-prescribing behavior among physicians is essential for the implementation of targeted interventions to reduce the potentially increasing ABR and disseminating resistant bacterial strains.^[6,13] A physicians' antibiotic-prescribing behavior plays a pivotal role in this process. An understanding of when antibiotics are required, and more importantly, when they are not will reduce their prescribing.^[14,15] As the changes in prescribers' knowledge and attitude affect the antibiotic-prescribing patterns, it is important to understand what physicians know about antibiotics, ABR, how they acquire and maintain their knowledge, and what factors influence their prescribing practices. Understanding the physician's perspective in this regard will help in formulating more effective strategies to promote the rational use of antibiotics.

In the light of the above situation, the aim of this study is to understand the knowledge, attitude, and practices (KAP) of health-care providers (HCPs) toward antibiotics, antibiotic prescribing, ABR, and MDR-TB.

MATERIALS AND METHODS

Study design

This study was a cross-sectional, questionnaire-based survey and used qualitative methods to explore the knowledge attitude and practices of the primary care physicians toward antibiotics, antibiotic prescribing, ABR, and MDR-TB.

Study population

A total of 125 HCPs/primary care physicians working in both government and private tertiary care teaching hospitals in Delhi-NCR were included in this study.

Study questionnaire

The questionnaire we used was developed by modifying the earlier one, used and validated by Teixeira Rodrigues *et al.*^[16] The questionnaire was validated by subject experts for its content and relevance. The final questionnaire consisted of two parts: Part 1 and Part 2. Part 1 was divided into two subsections: Part 1(A) which sought the sociodemographic and professional information of the participants and Part 1(B) which consisted of 17 statements designed to assess the KAP details about the antibiotic use, prescribing behavior and ABR [Table 2]. Part 2 consisted of 11 statements designed to assess the awareness regarding

Table 1: Factors associated with inappropriate antibiotic usage

1	Physician's nonadherence to treatment guidelines
2	Lack of knowledge and training regarding the rational use of antibiotics
3	Lack of diagnostic facilities or uncertainty over the diagnosis
4	Inadequate knowledge regarding local resistance pattern
5	Fear of clinical failure
6	Pressure from pharmaceutical industry
7	Pressure from patient to prescribe antibiotics regardless of any indication
8	Self-prescribing or over-the-counter purchase of antibiotics

MDR-TB and about the prescription of antituberculosis therapy (ATT) [Table 3]. It also consisted of a final part in which physicians or HCPs were asked to freely express their views on antibiotics and ABR including MDR-TB. A 5-point Likert scale, whose responses ranged from “strongly agree” to “do not know,” was used for both Part 1 and Part 2 of the questionnaire.

Ethics approval and participant consent

Before the survey, Institute’s Ethics Committee (IEC) approval and written informed consent were obtained from all the participants.

Statistical analysis

The data obtained were managed on an Excel spreadsheet. Simple descriptive statistics were used to generate frequencies, percentages, and proportions. Wherever relevant, the Chi-square test was used to determine the statistical significance.

RESULTS

The response rate was 100% among the 125 doctors/HCPs who participated in the survey.

The number of respondents who agreed that ABR is an important and a serious public health issue was significantly higher (94.4%). The majority of the respondents agreed that an indiscriminate and irrational use of antibiotics could lead to the emergence of ABR.

More than 80% of the respondents strongly agreed that dispensing antibiotics without prescription/over-the-counter sale of antibiotics should be controlled. About 69.6% of the respondents agreed that self-medication and misuse of antibiotics are two major causes of ABR.

Only 27.2% of the participants agreed that microbiology reports should be waited for, before treating infectious diseases; however, the majority of the participants (72.8%) agreed that rapid and effective diagnostic techniques are required for diagnosing infectious diseases.

Almost 69.6% of the participants disagreed of prescribing antibiotics without any indication and 59.2% believed that there might be a direct correlation between prescribing antibiotics and emergence of ABR. Table 2 depicts the KAP of the HCPs pertaining to the prescription of antibiotics, their uses, and ABR.

The majority of the respondents were well aware about the MDR-TB and the associated factors responsible for the emergence of MDR-TB isolates. Nearly 86.4% of the

participants agreed that MDR-TB is a growing problem and 59.2% strongly agreed that indiscriminate use of anti-TB drugs could be a major causative factor. About 85.6% of the participants agreed that a proper diagnosis should be ensured before treating the TB cases and 57.6% strongly agreed that a decision to start ATT should be based on clinical, radiological, and bacteriological findings. Almost 69.6% of the participants acknowledged the critical role of chest physicians in this regard.

About 81.6% of the participants strongly agreed that continuing medical education (CME) programs will be helpful in the proper management of TB cases and prevention of the emergence and dissemination of MDR-TB isolates in the community. Table 3 depicts the awareness and attitude of HCPs toward MDR-TB.

DISCUSSION

This study provides a useful information about the KAP of HCPs toward antibiotic prescription and ABR. The majority of the respondents in our study were well aware of ABR being an important public health problem. The attitude of the study participants with regard to antibiotic use and resistance was found to be professional and stringent.

ABR is broadly associated with antibiotic overuse, misuse, or abuse and thus is related to the behavior of all the actors and factors involved. Although physicians have a pivotal role and critical responsibility as antibiotic use is mainly associated with their consulting and prescribing practices, the knowledge about the proper use of antibiotics is also essential in a patient’s part. Poor drug compliance, purchasing fewer units than prescribed, purchasing antibiotic without prescription, or using the same prescription repeatedly to save money and time are some patient-related factors which play a very important role in the development of ABR. Various patient-related factors responsible for the irrational use of antibiotics are enumerated in Table 4. Although in our study majority of the participants denied of prescribing antibiotics without indication or if insisted by patients to do so, but they did agree that sometimes patient demand strong medicines or the same antibiotics which they had earlier and had a relief with. Patients also believe that as they have spent money on consulting a doctor or waited for considerable period of time in the public facility, so a doctor is ought to prescribe antibiotics to them. Doctors often succumb to patients’ demands or expectations for antibiotic prescription.^[17]

Doctors said that they alone are not to be blamed, as they are not the only prescribers, and if other illegal

Table 2: Knowledge, attitude, and practices of the health-care providers pertaining to the prescription of antibiotics, their uses, and antibiotic resistance

Question	Strongly agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Totally disagree (%)	Do not know (%)
ABR is an important public health problem in our setting	104 (83.2)	14 (11.2)	3 (2.4)	2 (1.6)	2 (1.6)
In a primary care context, one should wait for the microbiology results before treating an infectious disease	34 (27.2)	42 (33.6)	26 (20.8)	20 (16)	3 (2.4)
Rapid and effective diagnostic techniques are required for diagnosis of infectious diseases	91 (72.8)	28 (22.4)	3 (2.4)	2 (1.6)	1 (0.8)
The prescription of an antibiotic to a patient does not influence the possible appearance of resistance	9 (7.2)	13 (10.4)	19 (15.2)	74 (59.2)	10 (8)
I am convinced that new antibiotics will be developed to solve the problem of resistance	18 (14.4)	38 (30.4)	31 (24.8)	23 (18.4)	15 (12.0)
The use of antibiotics on animals is an important cause of the appearance of new resistance to pathogenic agents in humans	20 (16.0)	29 (23.2)	28 (22.4)	20 (16.0)	28 (22.4)
In case of doubt, it is preferable to use a wide-spectrum antibiotic to ensure that the patient is cured of an infection	38 (30.4)	46 (36.8)	26 (20.8)	11 (8.8)	4 (3.2)
I frequently prescribe an antibiotic in situations in which it is impossible for me to conduct a systematic follow-up of the patient	16 (12.8)	54 (43.2)	32 (25.6)	19 (15.2)	4 (3.2)
In situations of doubt as to whether a disease might be of bacterial etiology, it is preferable to prescribe an antibiotic	24 (19.2)	39 (31.2)	43 (34.4)	18 (14.4)	1 (0.8)
I frequently prescribe antibiotics because patients insist on it	7 (5.6)	23 (18.4)	24 (19.2)	68 (54.4)	3 (2.4)
I sometimes prescribe antibiotics so that patients continue to trust me	10 (8.0)	11 (8.8)	21 (16.8)	81 (64.8)	2 (1.6)
I sometimes prescribe antibiotics, even when I know that they are not indicated because I do not have the time to explain to the patient the reason why they are not called for	4 (3.2)	10 (8.0)	22 (17.6)	87 (69.6)	2 (1.6)
If a patient feels that he/she needs antibiotics, he/she will manage to obtain them at the pharmacy without a prescription, even when they have not been prescribed	46 (36.8)	35 (28.0)	10 (8.0)	23 (18.4)	11 (8.8)
Two of the main causes of the appearance of ABR are patient self-medication and antibiotic misuse	87 (69.6)	23 (18.4)	8 (6.4)	4 (3.2)	3 (2.4)
Dispensing antibiotics without a prescription should be more closely controlled	101 (80.8)	15 (12.0)	3 (2.4)	6 (4.8)	0 (0)
In a primary care context, amoxicillin is useful for treating most respiratory infections	49 (39.2)	50 (40.0)	13 (10.4)	5 (4.0)	8 (6.4)
The phenomenon of resistance to antibiotics is mainly a problem in hospital settings	33 (26.4)	45 (36.0)	29 (23.2)	17 (13.6)	1 (0.8)

ABR=Antibiotic resistance

Table 3: Awareness and attitude of health-care providers toward multidrug-resistant tuberculosis

Question	Strongly agree (%)	Somewhat agree (%)	Somewhat disagree (%)	Totally disagree (%)	Do not know (%)
MDR-TB is a genuine problem	108 (86.4)	10 (8.0)	6 (4.8)	0 (0)	1 (0.8)
Second-line drugs are now being increasingly used	55 (44.0)	58 (46.4)	8 (6.4)	1 (0.8)	3 (2.4)
Indiscriminate use of antibiotics is a major cause	74 (59.2)	36 (28.8)	10 (8.0)	3 (2.4)	2 (1.6)
MDR-TB can be treated by general practitioner	15 (12.0)	23 (18.4)	40 (32.0)	41 (32.8)	6 (4.8)
Clinical practice guidelines is a useful tool	73 (58.4)	29 (23.2)	11 (8.8)	9 (7.2)	3 (2.4)
It is important to ensure appropriate diagnosis and treatment of cases	107 (85.6)	14 (11.2)	3 (2.4)	0 (0)	1 (0.8)
Chest physicians play a major role in this area	87 (69.6)	29 (23.2)	7 (5.6)	1 (0.8)	1 (0.8)
Type of practice (private/government/academic institution) influences the treatment	63 (50.4)	39 (31.2)	9 (7.2)	8 (6.4)	6 (4.8)
Social problems and switching between doctors are one of the causes for emergence of resistance	63 (50.4)	45 (36.0)	14 (11.2)	2 (1.6)	1 (0.8)
Decision to start ATT should be					
Clinical	19 (15.2)	06 (4.8)	30 (24.0)	69 (55.2)	1 (0.8)
Clinical + radiological	27 (21.1)	13 (10.4)	60 (48.0)	24 (19.2)	1 (0.8)
Clinical + radiological + bacteriological	72 (57.6)	11 (8.8)	33 (26.4)	9 (7.2)	0 (0)
Continuing education course is helpful tool	102 (81.6)	19 (15.2)	2 (1.6)	0 (0)	2 (1.6)

MDR-TB=Multidrug-resistant tuberculosis, ATT=Antitubercular therapy

prescriptions were stopped/regulated, then the problem of antibiotic misuse can be curbed down substantially. Illegal dispensing/over-the-counter sale of antibiotic is a major contributing factor for antibiotic misuse or abuse in many developing countries including India. Pharmacists

often dispense antibiotic without prescription or on old prescription. In India, many pharmacy shops lack a trained personnel or have only one qualified pharmacist being assisted by many untrained personnel. This can lead to the error in dispensing of medicines. They also

said that “quacks” dispense loose drugs without proper dosage or duration. They follow a legally trained doctor’s prescriptions without knowing the proper diagnosis. Poor patients approach them due to money constraints and to avoid long waiting hours. Moreover, professionals from Ayurveda, Yoga, Unani, Siddha, and Homeopathy also prescribe allopathic medicines (mostly antibiotics) for economic survival. Improper and irrational use of antibiotics by these professionals who are legally not entitled to prescribe does contribute to the increasing ABR. This issue deserves serious attention, and clear policies are needed to designate eligible prescribers.

With reference to the appropriate antibiotic use, only 27.2% of the participants agreed that microbiology reports should be waited for, before treating infectious diseases. Reason being, prolonged turnaround time of the microbiology reports, which ranges from 48 to 72 h for normal culture and sensitivity to 5–7 days for blood culture or even longer for acid-fast bacilli culture. It has been shown that access to rapid diagnostic tests improves antibiotic prescribing^[18] and 72.8% of our participants also agreed to the same.

Only 44.8% of the participants agreed (14.4% strongly agreed and 30.4% somewhat agreed) that the development of new antibiotics will solve the problem of ABR. To make a difference, what needs to be changed is the perception and knowledge about the antibiotic and ABR among all the stakeholders (physicians, patients, and pharmacists). Awareness among the public about infection, antibiotics, and their indications is limited and the same was admitted by HCPs in our study too. Empowering the public through education and media is very important. An international study has shown that an empowerment technique using leaflets and posters improves awareness about antibiotics and generates relevant questions to doctors.^[19] However, media coverage of ABR and its implications is negligible in comparison to the issues such as AIDS and smoking. Studies have also shown that intervention for improving patient communication can reduce antibiotic prescription rates by 60%.^[19] The major interventions needed to stop the misuse of antibiotics are listed in Table 5.

Mycobacterium tuberculosis is becoming a more deadly pathogen day by day with the introduction of drug resistance in its genome, commonly known as MDR-TB and XDR-TB. Knowledge, attitude, and awareness about MDR and XDR-TB, factors associated with its transmission, diagnostic tests available, and different treatment modalities used are very important in high-burden countries, such as India, as the risk of exposure to drug-resistant bacilli is at maximum.^[20,21]

Table 4: Various patient-related factors responsible for irrational use of antibiotics

Patient-related factors	Reason
Improper dosage	Overuse or underuse of antibiotics
Lack of follow-up	Expensive consultant fee (private sector), long waiting hours (public Sector), patient either cured or repeat the prescribed medicines to save time and money
Doctor shopping	A patient seeks instant care and tries one doctor after another
Self-medication	Repeatedly using the same prescription for similar complaints
Consulting quacks and other professionals	Money and time constraints

Table 5: Major interventions required to stop antibiotic misuse

Intervention	Purpose
CME programs	To create awareness among HCPs regarding rational use of antibiotics
Educating the patient	To create awareness among patients about proper use of antibiotics, by leaflets, posters, and newspapers
Issue proper guidelines	Proper guidelines for appropriate antibiotic usage should be supplied to all community hospitals and doctors
Stringent rules and regulations	To check over-the-counter sale of drugs by pharmacists and prescribing by illegal practitioners
Denying pressured prescription	Not to prescribe antibiotic without indication under patients’ pressure or for financial gain from pharmaceutical companies

CME=Continuing medical education, HCPs=Health-care providers

HCPs are the main avenue for creating awareness, so their level of knowledge should be higher than others. Our findings showed that 86.4% of the participants were aware of MDR-TB and agreed that its emergence is a genuine problem. Inappropriate therapy for TB is the main risk factor for the emergence of resistant isolates, and it is usually associated with intermittent drug usage, erroneous prescriptions, poor drug compliance on a patient’s part, and substandard TB drugs which lead to increased disease prevalence and the emergence of drug-resistant isolates. Poor knowledge about TB, even in the most educated group, constitutes a reason for increasing resistance in TB bacilli.^[22] Disease burden can be lowered in any community by well-informed HCPs who can educate patients, as well as the general population about TB, increasing resistance, and emerging MDR-TB isolates.^[23,24]

Isoniazid and rifampicin are keystone drugs in the management of TB. While resistance to either isoniazid or rifampicin may be managed with other first-line drugs, resistance to both isoniazid and rifampicin (MDR-TB) demands treatment with second-line drugs which have limited sterilizing capacity and are not suitable for short-course treatment. Thus, patients with MDR-TB require prolonged treatment with drugs that are less

effective and more toxic. Therefore, it is necessary to distinguish MDR-TB from mere drug-resistant TB, as the therapeutic implications are different. Nearly 86.5% of the participants in our study strongly agreed that appropriate diagnosis is very important for proper treatment of patients and 57.6% strongly agreed that clinical, radiological, and bacteriological findings should be considered before starting ATT. About 69.6% of the HCPs agreed that chest physicians have a very critical role to play in this. Rapid diagnosis is a key factor in the management of MDR-TB strains, and in this sense, molecular analysis is quite helpful which not only detects the resistant strains but also specifies the particular mutation involved in the resistance, which helps to identify strains with high degree of resistance. In addition, the assignment of specific mutations can serve as an epidemiological marker for resistant strains.

The majority of the participants (81.6%) in our study strongly agreed to the point that CME programs will be helpful in the proper management of TB cases and prevention of the emergence and dissemination of MDR-TB isolates in the community. Most of the participants suggested that strictly following the DOTS guidelines, patient compliance to the treatment and educating the patients to strictly adhere to the treatment schedule are some key factors to prevent the emergence and dissemination of MDR-TB isolates.

Antibiotic stewardship programs – The way forward

To limit the spread of ABR, antibiotic stewardship programs (ASPs) and promoting the thoughtful prescribing of antibiotics are need of the hour. According to the Infectious Diseases Society of America, the definition of antimicrobial stewardship includes optimizing the indication, selection, dosing, route of administration and duration of antimicrobial therapy to maximize clinical cure, and prevention of infection while limiting the collateral damage of antimicrobial use, including toxicity, selection of pathogenic organism (such as *Clostridium difficile*), and emergence of resistance.^[25] ASPs are probably the most effective way of controlling the spread of ABR and enhancing patient safety. Furthermore, what is needed is a major shift in mindset from one that regards antibiotic stewardship as a cost-saving program, to one which sees it as essential for patient safety and quality improvement. The core elements to the success of ASPs are listed in Table 6.^[26]

CONCLUSIONS

It was observed in our study that HCPs had a good knowledge of antibiotics and the association of its misuse or overuse with increasing ABR. Inadequate dosages,

Table 6: Seven core elements critical to the success of hospital antibiotic stewardship programs

S.No.	Core Elements	Intended Responsibilities
1	Leadership commitment	Dedicating necessary human, financial, and information technology resources
2	Accountability	Appointing a single leader responsible for program outcomes (usually a physician)
3	Drug expertise	Appointing a single pharmacist leader responsible for working to improve antibiotic use
4	Action	Implementing at least one recommended action, such as systemic evaluation of ongoing treatment needed after a set period of initial treatment
5	Tracking	Monitoring antibiotic prescribing and resistance patterns
6	Reporting	Regular reporting information on antibiotic usage and resistance to doctors, nurses, and relevant staff members
7	Education	Educating clinicians about resistance and optimal prescribing

noncompliance to the prescribed dosage, sale of antibiotics over-the-counter or from quacks were mentioned as common practices responsible for growing ABR. Suggested remedial strategies dwelt on improving public awareness, better communication, improved diagnostic support, continuing educational programs, and regulation enforcement.

Educational and persuasive measures are certainly needed, but the use of restrictive and organizational measures appears mandatory if the misuse of antibiotics is to be decreased in the near future. A stringent assessment of the impact of implemented measures seems essential to better guide antibiotic stewardship in our country.

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Conflicts of interest

There are no conflicts of interest.

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