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# 'Perceptions' and 'practices' to antibiotic usage among diabetic patients receiving care from a rural tertiary care center: A mixed-methods study

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## Abstract:

**BACKGROUND:** Contribution to antibiotic resistance can happen at two interfaces – doctor prescribing antibiotics inadvertently or patient's usage of antibiotics inadvertently. This study was conducted among diabetic inpatients in a rural tertiary health center in Kolar, South India, to assess the various practices related to antibiotic use and to explore the possible reasons for these practices with regard to antibiotic use.

**MATERIALS AND METHODS:** An exploratory sequential mixed-methods study was conducted with an initial cross-sectional quantitative study followed by qualitative in-depth interviews during August–September 2019. A pretested semi-structured questionnaire was used to capture the sociodemographic, disease-, and treatment-related characteristics and practices related to antibiotic use. An open-ended interview guide was used to conduct in-depth interviews. The practices to antibiotic use were reported using frequency (percentage). Manual descriptive content analyses were done by two investigators separately to identify codes under the broad topic “reasons for adopted practices with regard to antibiotic use.”

**RESULTS:** Of the 152 diabetic inpatients interviewed, 20 (13.2%) felt that antibiotics are safe drugs and can be used commonly. Among these inpatients, seven (4.6%) knew that antibiotics can kill bacteria and four (2.6%) perceived 'antibiotic resistance' as a big problem in India. The practice of checking the expiry date before using antibiotics was seen in 21 (13.8%) and 44 (29%) of them finished the full course of antibiotics. A total of six codes were identified under the broad theme of “reasons for adopted practices with regard to antibiotic use” among diabetic inpatients.

**CONCLUSIONS:** Less than one-third of them completed the antibiotic course given by the doctor, and almost everyone was ready for over-the-counter purchase of antibiotics offered by the pharmacist. The reasons for such practices were mostly attributed to the “partial drug purchases” and “incomplete advice by the doctor.” There is an urgent need to plan and deliver an interventional package to enhance the knowledge and inculcate good antibiotic usage practices among these high-risk populations.

## Keywords:

Antibiotic stewardship, diabetes mellitus, health education, noncommunicable disease, pharmacy

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## Introduction

Noncommunicable diseases are on the constant rise among low- and middle-income countries (LMICs) compared

to high-income countries.<sup>[1]</sup> The worldwide prevalence of diabetes has doubled over the last four decades.<sup>[2]</sup> At the family level, diabetic patients face huge out-of-pocket expenditure for their investigations and medications, leading to income shock in the

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families.<sup>[3]</sup> Due to the altered status of immunity among diabetes patients, there is an increased susceptibility to infections, both the most common ones and those that almost always affect only people with diabetes.<sup>[4]</sup> Due to frequent infections, diabetic patients have more exposure to antibacterial agents, which can lead to increased antibiotic usage and resistance rates.<sup>[5]</sup>

Higher antibiotic resistance rates in diabetic patients compared with those without diabetes have been reported in some studies.<sup>[6]</sup> In Indian outpatients with chronic wounds, most (70%) antibiotic-resistant bacteria were isolated from diabetic patients. To curb antibiotic resistance, not only the medical professions but also the patients have their roles to play. What is worrying? The public is generally not aware of antibiotic resistance and its adverse effects.<sup>[7,8]</sup> Studies done in western countries among the general public showed that the public was not clear about the nature and implications of antibiotic resistance and did not perceive any personal involvement in it. People attributed antibiotic resistance as something external that they were neither responsible for, nor, capable of control.<sup>[9-11]</sup>

Physician knowledge regarding antibiotic resistance and also their attitude towards it is an important aspect of antibiotic stewardship. A recent systematic review showed that the majority of the doctors knew about this problem and did acknowledge it as a serious issue (98% of them) but believed that it is caused by others and not by him/her.<sup>[12]</sup> In many countries globally and especially in LMICs like India, there is rampant “over the counter” sale of antibiotics from not only licensed pharmacists but also unlicensed drug distributors. This results in high levels of inappropriate use of antibiotics and thus, a consequent increase in antibiotic resistance.<sup>[13]</sup> These drug distributors, especially those unlicensed, may have insufficient training, and below-par skill levels and also a lower understanding, especially with respect to “antibiotic resistance.” They do also have a range of different relationships with formal and informal drug regulatory systems. These drug dispensers are also at a higher risk of being influenced by financial incentives to sell antibiotics and also tend to accept the demand/requests/expectations from the customer or client side and without worrying about any repercussions even from the law.<sup>[14]</sup>

There are various studies conducted, especially in European countries and the United States of America, on the practices, prevalence, and patient perspectives of misuse of antibiotics.<sup>[15,16]</sup> A systematic review involving 54 studies showed that the public does not have a complete understanding of antibiotic resistance, and a lot of misperceptions and misconceptions do exist. These misunderstandings were mostly revolving around the

cause of antibiotic resistance, and most of them do not believe that they could contribute to its development.<sup>[17]</sup> A better understanding of the provider-patient interactions shall contribute to critical understanding and provide knowledge that could help in reducing these practices in the Indian setup, especially in rural areas. Studies looking into such patients and the patient-provider relationship with regard to antibiotic misuse have been done previously in India but in developed health-care infrastructure and urban settings.<sup>[18,19]</sup> A Study in Iran has shown that tailored appropriate educational programs based on social cognitive theory constructs can reflect a positive impact on appropriate antibiotic use in the community.<sup>[20]</sup> However, nearly two-third of the population stay in rural areas with very limited health-care infrastructure, and understanding their views and perceptions would yield significant knowledge in planning and curbing this antibiotic resistance.

The relation between an individual’s inappropriate attitude and use of antibiotics and the global threat of antibiotic resistance has not been optimally explored in India. With this background, this study was done among diabetic inpatients in a rural tertiary health center (a) to assess the various practices related to antibiotic use such as completion of prescribed schedule, re-use of prescriptions, over-the-counter purchase, use of leftover antibiotics in absence of medical advice, and others and (b) to explore the possible reasons for these practices with regard to antibiotic use.

## Materials and Methods

An exploratory sequential mixed-methods study design with an initial cross-sectional quantitative study followed by qualitative in-depth interviews to know the perceptions regarding antibiotic use was conducted during August–September 2019 among diabetic inpatients in a tertiary health-care center in South India.<sup>[21]</sup>

This center is a medical college hospital situated in a rural area catering to the majority of the population who are dependent on agriculture for their livelihood and belong to lower socioeconomic class. The hospital has a 1000-bedded facility with access to 24 × 7 multispecialty care with major diabetic inpatient admission to the Departments of General Medicine and General Surgery. The hospital has a separate 15-bedded intensive care unit managed by specialty care of General Medicine and Anesthesia Departments.

All the patients with a known history of type 2 diabetes of any duration and admitted under departments of medicine and surgery were included in the study. Diabetes patients with any history of psychiatric

morbidity were excluded from the study. All diabetics who were admitted to the intensive care unit and those patients who were critically ill and thus unable to respond to the questionnaire were also excluded from the study.

### Sample size and sampling method

#### Quantitative

With an expected good practice of antibiotic use among diabetics to be 50%, and with absolute precision of 8% and with two-sided confidence interval of 95%, the minimum sample size was calculated to be 151 (calculated using OpenEpi Version 3.01). Considering 40 working days in 2 months, four new inpatients who were diabetics were randomly selected and interviewed at the bedside.

#### Qualitative

Among the diabetic inpatients, a purposive sampling strategy based on the interaction and responses to the semi-structured interview schedule administered as part of quantitative research methods was used to select patients for in-depth interviews till we reached data saturation (a total of five patient interviews were conducted).

### Study tool

Sociodemographic details such as age, gender, monthly family income, occupation, education, family type, marital status, and number of members in the family; disease-related factors such as duration of diabetes and associated co-morbidity; and treatment-related factors such as insulin use and practices related to antibiotic use were captured using a pretested semi-structured validated questionnaire. An open-ended interview guide was used to conduct in-depth interviews to capture the qualitative data.

### Study procedure

#### Quantitative

All patients were administered the semi-structured validated questionnaire through interview technique at the time of their stay (mostly on the 1<sup>st</sup> day of hospitalization) at the hospital. The interview was done by a female medical student who was well trained with the administration of questionnaires in the local language. Informed consent was obtained from all the study participants before the start of the interview.

#### Qualitative

In-depth interviews were done by a trained qualitative researcher (male medical doctor), with the female student taking the role of notetaker after obtaining informed written consent. The interviews were conducted in the local language and the interview was noted in the English language directly by the student and was later typed into a word document on the same day of the

interview for analysis purposes. At the end of each interview, the investigators read out the notes summary in their language and confirmed the validity of the same (member checking).

### Statistical analyses

#### Quantitative

Data were single entered using EpiData software version 3.1 (EpiData Association, Odense, Denmark). Data were analyzed using Stata statistical software version 11 (StataCorp LP, College Station, TX, USA). Continuous data such as age was expressed using mean (standard deviation [SD]). All the categorical data were expressed in counts (percentage). The practices to antibiotic use were reported using frequency (percentage).

#### Qualitative

Manual descriptive content analyses were done by two investigators separately to identify codes under the broad topic “reasons for adopted practices with regard to antibiotic use.” The analysis was reviewed by a third person, and any disagreements between researchers were resolved by discussion. The final results were reported using categories or codes along with verbatim quotes.

### Ethical considerations

Prior to the onset of the study, ethical approval was obtained from Institutional Ethics Committee (SDUMC/KLR/IEC/26/2019-20). Written informed consent was obtained from all the study participants.

## Results

### Quantitative

Of the 152 diabetic inpatients studied, the mean (SD) age was 59.3 (12.3) years and males were 106 (69.7%) [Table 1]. Among the 152 diabetic inpatients, 18 (11.9%) had a duration of diabetes to be <1 year. Of the 152 patients, 82 (54%) were on insulin treatment at the time of assessment [Table 2].

Of the 152 diabetic inpatients interviewed, 20 (13.2%) felt that antibiotics are safe drugs and can be used commonly. Among these inpatients, seven (4.6%) knew that antibiotics can kill bacteria and four (2.6%) perceived “antibiotic resistance” as a big problem in India [Table 3]. In general, the practice of checking expiry date before using antibiotics was seen in 21 (13.8%) and 44 (29%) of them finished the full course of antibiotics. In the given hypothetical situation, most of them said they would take antibiotics without prescription on the advice of a pharmacist (149, 98%) or if the antibiotic is the one usually prescribed by their doctor (151, 99.3%) [Table 4].

**Table 1: Sociodemographic characteristics of diabetic inpatients in a rural tertiary health center in Kolar, South India (n=152)**

Study characteristic	n (%)
Age (years), mean±SD	59.3±12.3
Gender	
Male	106 (69.7)
Female	46 (30.3)
Occupational status	
Employed	109 (71.7)
Un-employed	43 (28.3)
Educational status	
No formal education	95 (62.5)
Primary/secondary school	40 (26.3)
College and above	17 (11.2)
Family type	
Nuclear	75 (49.3)
Joint/three generation	77 (50.7)
Marital status	
Currently married	122 (80.3)
Others*	30 (19.7)
Socioeconomic status†	
Class I	1 (0.6)
Class II	20 (13.2)
Class III	55 (36.2)
Class IV	43 (28.3)
Class V	33 (21.7)

\*Includes unmarried/widowed, †According to modified B G Prasad classification January 2019. SD=Standard deviation

**Table 2: Disease- and treatment-related characteristics of diabetic inpatients in a rural tertiary health center in Kolar, South India (n=152)**

Study characteristic	n (%)
Duration of diabetes (years)	
<1	18 (11.9)
1-5	61 (40.1)
6-10	38 (25.0)
>10	35 (23.0)
Any co-morbidity	
Present	68 (44.7)
Absent	84 (55.3)
Hypertension	
Present	49 (32.2)
Absent	103 (67.8)
Taking insulin	
Yes	82 (54.0)
No	70 (46.0)

### Qualitative

A total of six codes were identified under the broad theme of “reasons for adopted practices with regard to antibiotic use” among the diabetic inpatients.

### Partial drug purchase

Most of the patients felt antibiotics as similar to other drugs and they used the same drug procurement policy for antibiotics too, thus making them contribute to

the consumption of antibiotics in less than prescribed doses.

“As with any other tablets, we usually buy half of what he (doctor) prescribes and then get back to pharmacist only if it doesn’t reduce” (53-year-old male).

### Belief in doctor/pharmacist

The diabetic inpatients more often than not were not checking for expiry dates and this was not something unique to antibiotics but also in the case of other drugs. They had the belief in their pharmacist or doctors who dispensed them these drugs or antibiotics and thus were not bothered to check for expiry.

“If we are taking drugs from our doctor and pharmacist, wouldn’t they have checked this manufacturing or expiry dates?” (50-year-old female).

### Incomplete advice by the doctor

It was found that none of the consulting doctors emphasized on the completion of the full course of antibiotics or the ill effects that could arise out of underdosing of antibiotics.

“The doctor never told us to take full tablets.... Once we are ok we automatically stop using them” (55-year-old female).

### Same/repeat prescriptions

This is a feature seen mostly among the doctors at public health-care facilities, where more often than not the prescriptions are driven by the availability of drugs in the pharmacy. Thus, the patients get used to a certain drug or antibiotic and prefer to take the drug beforehand without consultation.

“It is the same yellow tube tablet he gives.... that now I only go and get from my pharmacy directly and it works fine....when it doesn’t I do tell him (doctor) that... “that drug did not work for me this time”...” (48-year-old male).

### Fear of hospitalization

A common feeling among diabetic patients was fear of hospitalization for problems that they feel do not require any admission.

“See if I had gone to the pharmacy I would have taken tablets and stayed at home, now because I came to see the doctor I am in the ward and taking these saline bottles (referring to the intravenous fluids administered)” (70-year-old male).

### Waiting period at clinics/hospitals

Longer waiting periods and also referral to other doctors in the same hospital were seen as a deterrent to consult

**Table 3: “Perceptions” to antibiotic use among diabetic inpatients in a rural tertiary health center in Kolar, South India (n=152)**

“Perceptions” to antibiotic use	Number responding as “yes”, n (%)
Antibiotics are safe drugs; hence, they can be commonly used	20 (13.2)
Antibiotics can kill bacteria	7 (4.6)
Antibiotics can kill viruses	3 (2.0)
When one has a sore throat/cold, one should take antibiotics to prevent getting a more serious illness	1 (0.7)
You usually know if you need an antibiotic for a sore throat/cold before seeing a doctor	0
By the time you are sick enough to visit a doctor with a bad cold, you usually expect a prescription for antibiotics	0
The use of antibiotics when you are sick to remain active (at work, family uncton) without prescription is appropriate	1 (0.7)
Is antibiotic resistance a big problem in India?	4 (2.6)

**Table 4: “Practices” to antibiotic use among diabetic inpatients in a rural tertiary health center in Kolar, South India (n=152)**

“Practices” to antibiotic use	Number responding as “yes”, n (%)
General:	
Do you check the expiry date of the antibiotic before using it?	21 (13.8)
Do you consult a doctor before starting an antibiotic?	146 (96.1)
Do you always finish a full course of antibiotics?	44 (29.0)
Have you ever kept leftover antibiotics for further use?	26 (17.1)
Hypothetical situation 1: Just imagine you have a cold/fever. In the following situations when you have a cold/fever whether you will take the antibiotic or not without a prescription?	
Over the weekend in a normal situation	0
Over the weekend with an important event coming up	4 (2.6)
On holiday out of the station	2 (1.3)
You have no time to go to the doctor	31 (20.4)
When it is difficult to contact the doctor	71 (46.7)
When the doctor has no time to see you immediately	91 (59.9)
When a consultation with a doctor is too expensive	28 (18.4)
When you have a good experience with taking this antibiotic	111 (73.0)
When your doctor always prescribes you this antibiotic	151 (99.3)
When the pharmacist advises you which antibiotic to take	149 (98.0)
Hypothetical situation 2: The doctor prescribes a course of antibiotics for you. After taking 2-3 doses you start feeling better	
Do you stop taking further treatment?	110 (72.4)
Do you save the remaining antibiotics for the next time you get sick?	29 (19.1)
Do you discard the remaining, leftover medication?	124 (81.6)
Do you give the leftover antibiotics to your friend/roommate if they get sick?	5 (3.3)
Do you complete the full course of treatment?	42 (27.6)

doctors and rather opt for over-the-counter drugs issued by the pharmacist.

“When my pharmacist can give me tablets then why should I wait and see the doctor?” (55-year-old female).

“...see sir, it is waste of time sitting in the hospital and we are sent from doctor to doctor... unless very serious I usually take tablets from pharmacy store... and it works fine” (48-year-old male).

## Discussion

The current mixed-methods study highlights that diabetic inpatient did not perceive antibiotic resistance as a major problem in India (<3% felt it as an essential big problem). Less than one-third of them completed the antibiotic course given by the doctor, and almost everyone was ready for over-the-counter purchase of antibiotics offered by the pharmacist. The reasons for such practices were found which were mostly attributed to the “partial drug purchases,” “incomplete advice by doctor,” and others.

A community-based cross-sectional study among the general public in Malaysia showed that about three-fourth of them could identify that antibiotics were given for bacterial infections with the majority of them thinking wrongly that it is also given for viral infections (67%).<sup>[22]</sup> The current showed that only about 5% of them knew that antibiotics were used against bacterial infections. The differences mainly could be attributed to the differentials in sociodemographic profiles across two studies, with the majority of current study participants having no formal education (63%).

Various studies across different countries showed a varied response when asked about taking antibiotics or expecting to be prescribed antibiotics for cold ranging from 3% in Sydney to 38% in Malaysia.<sup>[22-25]</sup> The current study had almost none of them expecting any antibiotics for cold (<1%). The difference could be in the cultural practices wherein symptom of “cold” is not viewed

so seriously for warranting any antibiotics unlike the symptom of “fever.” These varied results also show the need for region-specific studies and also adopting research designs that could answer the “why?” of it, which could help in planning interventions.

The current study also showed that very few (<3%) felt “antibiotic resistance” to be a major problem in India. This result must be interpreted with caution and cannot be generalizable, mainly due to the study population adopted. They are mostly of rural background, with around two-third of them having no formal schooling. This also calls for the need of planning and delivery of interventional packages to the rural audience. Hospital visits could be a point of delivery of these interventions through various audiovisual modes, especially in high-risk groups like diabetes patients. Changing the attitude among the public and improving their knowledge regarding the safe use of antibiotics will be an important early strategy to preserve the effectiveness of antibiotics in this emerging era of resistance.

A systematic review done about a decade and a half back itself had shown that “noncompliance to the prescribed doses” and also “use of leftover antibiotics” were two important ways of contributing to inappropriate antibiotic use.<sup>[26]</sup> The current study shows that only 30% of the diabetic inpatients finish the full course of antibiotics and about 17% of them still keep the leftover antibiotics for further use and among them, about 3% share these leftover medications with friend/roommate.

The qualitative component of the study gave insights into adoption for such practices with one unique feature to our setting being the habit of “partial purchase of drugs.” This was the case not only with antibiotics but also in general during the drug purchase which would hamper the chances of taking a complete course of antibiotics. Further added to this was a lack of health education or advice while prescribing antibiotics among health-care providers. This could mainly be due to the heavy patient load in the outpatient departments not only in the public but also private sector combined with a lack of comprehension of importance in the delivery of the key message to “complete full course of antibiotics” drug prescription by the health-care providers.

A few of the reasons attributed to the “over-the-counter” purchase of antibiotics included “same/repeat prescriptions,” “fear of hospitalization” if a doctor is consulted, and also “waiting time” at the clinic or hospitals. Similar results were seen in another qualitative study done in Haryana which showed factors such as “limited healthcare access” and “economic factors” to be the factors leading to “over-the-counter” purchase. The quantitative part of the study showed concurrent

findings with about half of the participants agreeing that they would opt for over-the-counter drugs in case it is difficult to access doctors and also about one-fifth of them felt “cost of doctor” as a factor encouraging them for the same.

The study has a few strengths. First, the use of mixed-methods study design provided the background facts that lead to the perceptions seen with regard to antibiotic usage among the diabetic inpatients. Second, this is the first of its kind study in assessing the antibiotic usage and perceptions leading to it in a high-risk group like diabetic inpatients. Third, we have done member checking at the time of data collection and also used manual content analysis of qualitative data which is considered the gold standard for analysis.<sup>[27]</sup> Fourth, we have used error-free EpiData software for the entry of quantitative data. Finally, we adhered to STrengthening the Reporting of OBServational studies in Epidemiology and Consolidated criteria for reporting qualitative research (COREQ) guidelines for reporting the study findings.<sup>[28,29]</sup> The study is not without limitations. The study lacks generalizability owing to the profile of the patients and mostly belonging to the rural area and also the study was confined to a single health facility. We failed to assess the other spectrum of the study, i.e., perceptions of the treating physicians or doctors which was not the part of study objective. With all the necessary steps taken still, we cannot rule out the possibility of a loss of data during translation while note-taking the interviews.

## Conclusions

The diabetic inpatient did not perceive antibiotic resistance as a major problem in India. Less than one-third of them completed the full antibiotic course and almost everyone was ready for over-the-counter purchase. The reasons for such practices were found which were mostly attributed to the “partial drug purchases” and “incomplete advice by the doctor.” There is an urgent need to plan and deliver the interventional package to enhance the knowledge and inculcate good antibiotic usage practices among these high-risk populations.

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## Research quality and ethics statement

The authors of this manuscript declare that this scientific work complies with reporting quality, formatting, and reproducibility guidelines set forth by the EQUATOR Network. The authors also attest that no clinical investigations were done in this study. The study protocol was approved by the Institutional Ethics

Committee, and the corresponding protocol/approval number is No. SDUMC/KLR/IEC/26/2019-20. We also certify that we have not plagiarized the contents in this submission and have done a Plagiarism Check.

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### Conflicts of interest

There are no conflicts of interest.

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