Knowledge and perceptions on antibiotic use and resistance among high school students and teachers in New Delhi, India: A qualitative study

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Abstract:
Objective: To explore the perceptions and knowledge of school teachers and students about antibiotic use, resistance, and suggestions for practical interventions for the rational use of antibiotics.

Methodology: Five focus group discussions (FGDs) with high school students (Class: 9–11) and five with teachers were conducted in two private and three public schools (one teacher and one student FGD per school) in five municipal wards of Delhi. Qualitative data on antibiotic knowledge, resistance, and behaviors with respect to antibiotics use were collected. There were 4–8 persons per teacher FGD and 15–20 persons per student FGD. FGDs were analyzed using “thematic analyses.”

Results: Students had poor knowledge regarding antibiotics and antibiotic resistance, while only some teachers had a basic understanding. Four broad themes needing attention emerged: definition of antibiotic and antibiotic resistance, antibiotic use behavior, doctor–patient relationship, and interventional strategies suggested to curtail the misuse of antibiotics and to spread awareness. In order to tackle these problems, both groups suggested a multipronged approach including robust public awareness campaigns also involving schools, better doctor–patient relationships, and stronger regulations.

Conclusions: Although students and teachers exhibited poor knowledge about antibiotic use and resistance, they were keen to learn about these issues. School education programs and public education could be used to shape correct perceptions about antibiotic use among all stakeholders including children. This may help in the containment of antibiotic resistance and thus preservation of antibiotics for future generations.

Key words: Antimicrobial resistance, antimicrobial resistance awareness, appropriate use of antibiotics, high school students, high school teachers, intervention strategies

Several studies have targeted the role of clinicians and other health practitioners for irrational use of antibiotics that potentiates antimicrobial resistance (AMR) in the community.¹⁻³ At the community level, irrational antibiotic usage including misinformed notions on antibiotics, incomplete courses of medicine, and self-medication are major factors contributing to global AMR.⁴ In resource-strapped settings, where effective antibiotic surveillance systems are difficult to implement,⁵ antibiotic usage data are not available and evidence for high consumption of antibiotics is difficult to obtain. In such situations, community sensitization in form of antibiotic awareness and education may contribute toward controlling the rise of AMR as highlighted by several studies.⁶⁻⁷

The key to successful strategies for managing community-based AMR or antibiotic resistance is to promote behavior modification besides providing relevant information on proper antibiotic use.⁸ Therefore, it is important to understand each target group’s belief and perception about antibiotic use and resistance before undertaking any intervention. The most malleable user group at the community level is students in their formative years of schooling. As students spend nearly 7–9 h in school daily, among their peers and teachers,⁹ constructive behavioral aspects and knowledge imbibed through health education imparted by the teachers can have a

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deep impact on students who are both current and future users of antibiotics as well as influential advisors to parents.

Hence, this study targeted high school students as well as teachers to assess their baseline knowledge, attitude, and practices toward antibiotic use and resistance, acknowledging the role of schools in contributing to a sustainable mitigation of AMR. During the study, we used the terms antibiotic and antibiotic resistance as the antibiotic word is commonly used and understood term in the community, especially by stakeholders (teachers and students) with whom the study was conducted. Moreover, our focus was mainly on antibiotics that are commonly used against bacterial infections in the community and not antimicrobials used for the treatment of malaria, parasitic, and fungal diseases.

Methodology

This was a qualitative study to explore the perceptions and knowledge of high school students as well teachers in New Delhi about antibiotic use and resistance. The study involved two private and three government schools in five municipal wards of West Delhi. The five municipal wards were: Patel Nagar (East, West, and South), Rajinder Nagar, Rajouri Garden, and Naraina including Inderpuri and Karol Bagh. The choice of the area was guided by previous studies done in the same area by the lead author and others on antibiotic use in the community[10] and antibiotic prescription for the upper respiratory tract infection and diarrhea.[2,11] In order to collect adequate data on antibiotic usage, in limited time, focus group discussions (FGDs) which yield rich qualitative data[12] were used. FGD is an interactive, semi-formal group-based interview method conducted under the careful guidance of a facilitator and recorder on some focused theme.

Ethical approval for the entire study including the surveillance of antibiotic use (which is not reported here) and qualitative study was obtained from the WHO Ethics Review Committee. Approval was also obtained from the institutes of AK and CW for the study. Permission from the individual school principal and liaison with the designated teachers was done for conducting FGDs. Informed consent of the participants was sought and in the case of students, the consent form was sent to their parents for approval and signature before conducting the FGD. Five FGDs (n = 5) each were conducted for both teachers and students. Four to eight teachers and 15–20 (Class: 9–11) students took part in the FGDs. Teachers who organized student FGDs could not reduce the number of students as they picked the students from three classes with many students volunteering for the group discussion. All FGDs were conducted with AK and CW as facilitators and a social scientist helping to conduct and analyze the FGDs. Each FGD lasted between 90 and 120 min.

A topic guide was used which had four main domains [Box 1]: Definition of antibiotic and antibiotic resistance, use of antibiotics including behavior and access to antibiotics, knowledge and information on antibiotic use, and interventions suggested by each group. The discussion centered on these broad themes and probes were initiated from the answers of the participants. At FGDs, the facilitators encouraged participants to explore the primary discussion in depth to reflect their own issues. Use of theoretical sampling and theoretical saturation was made in successive FGDs. The FGD was preceded by a brief introduction of the study and the significance of including important stakeholder groups (viz., students/teachers) in the study to collect an inclusive set of information about the antibiotic use, knowledge, and perceptions.

All FGDs were videotaped, transcribed and translated where required. This was followed by thematic analysis[22,23] [Figure 1]. The themes were identified through theoretical sampling and theoretical saturation. There was a continuous analysis of all FGDs throughout the study from the beginning till the end. Thematic analysis is an inductive method that helps to formulate narrow themes from a wide spectrum of patterns that emerge from the responses in the FGDs. The opinions of the participants were processed anonymously.

Results

Thematic analysis resulted in the identification of four major themes.[13] These themes were the definition of antibiotic and antibiotic resistance, antibiotic use behavior, doctor–patient relationship, interventions and strategies suggested curtailting misuse of antibiotics, and raising awareness. Table 1 indicates

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**Box 1: Topic guide**

- Definition of antibiotic and antibiotic resistance
  - How will you define antibiotic?
  - How do antibiotics work?
  - What is antibiotic resistance or antimicrobial resistance?
  - What do you understand by the term antibiotic/antimicrobial resistance/AMR?
- Use of antibiotics, including behavior and access to antibiotics
  - Have you ever used any antibiotic?
  - Could you recollect for what condition/symptom antibiotic was used?
  - Who prescribed antibiotics to you?
  - From where did you get the antibiotics?
  - Do you generally ask for antibiotic?
  - How do you generally purchase/get antibiotics?
- Knowledge and information on antibiotic use
  - Generally for how many days doctor prescribe antibiotic?
  - Do you always buy antibiotic for 3 or 5 days?
  - Do you always complete the course of antibiotics?
  - Do you generally have left-over antibiotics at home?
  - Does your doctor specify that he is prescribing antibiotic to you?
  - Does your doctor give you any instruction while prescribing antibiotic?
  - What is their source of knowledge on the use of antibiotics?
- Interventions suggested
  - How to increase the awareness about antibiotics, antibiotic resistance, and appropriate use of antibiotics?
  - How can schools be involved in increasing awareness about this topic?

AMR = Antimicrobial resistance
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| Major theme                                             | Subtheme and important message                                                                 |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| **Definition of antibiotic and antibiotic resistance** | Teachers and students<br>Suboptimal knowledge for both antibiotic and antibiotic resistance     |
| **Antibiotic use behavior**                            | Teachers<br>Desire for an instant cure<br>Using old prescriptions and self-medication without prescription<br>Not taking full course<br>Cost of medicine<br>Students<br>Antibiotics are generally<br>Consumed for cough/cold/diarrhea<br>Bought from pharmacists as OTC<br>Consumed for 1-2 days |
| **Doctor–patient relationship**                        | Teachers<br>No counseling from doctors<br>Not taking risk<br>Patient pressure<br>Closed behavior of doctors<br>Dispensing doctors – not providing prescription and name of medicines<br>Students<br>Cannot/escalation in asking questions to doctors<br>Doctors do not provide complete knowledge about prescribed medicines<br>Doctor do not stress on completing the course of antibiotic |
| **Interventions and strategies suggested to curtail misuse of antibiotics and to spread awareness** | Teachers<br>Incorporating relevant information into school text<br>Doctors should be trained on patient counseling and on doctor–patient interaction<br>Information about antibiotic use and AMR to be spread as done for polio program through slogans, billboard, posters, television, newspapers, etc.<br>Public awareness messages to encourage patients to ask questions to doctors about their diseases and medicines<br>Labeling antibiotics in different color with instructions<br>Students<br>Education on antibiotics will help them to ask relevant questions from doctors and curtail misuse of antibiotics<br>Information on antibiotics to be taught in Class 10<br>Mass media campaigns on the rational use of antibiotics including posters displayed in schools and in popular magazines<br>Stricter regulation for OTC sell of antibiotics |

OTC=Over-the-counter, AMR=Antimicrobial resistance

**Table 1: Major themes and subthemes that emerged from the focus group discussions with high school teachers and students**

*Figure 1: A pictorial representation of the thematic analysis method*

**the major themes and subthemes that emerged from the analysis.**

**Definition of Antibiotic and Antibiotic Resistance**

**Teachers**

Teachers felt that antibiotics increase the immunity of a person and are effective in providing immediate relief. Some believed antibiotics work against infection-causing bacteria, whereas others believed that antibiotics are different from “general” medicines such as antihistamines and paracetamol. “Antibiotics are for bacterial or fungal infection” Teacher 3. “Generally these don’t have side-effects, we can say. That’s what I know” Teacher 8.

Most thought that antibiotics were “good” posing no harm to health and “strong” which made them effective and indispensable for treatment. However, many teachers believed that antibiotics have many side-effects such as damaging the liver, loss of appetite, and allergic reactions. A few teachers knew the names of some antibiotics such as amoxicillin, norfloxacin, and ciprofloxacin.

Teachers were not very sure about what AMR or antibiotic resistance is, nor its causes or consequences. “Resistance
basically means, it is safe… Immunity power. Otherwise, the disease may affect the children (individual). For me that is resistance power” Teacher 1. One teacher thought that as antibiotics are strong so they decrease the body’s immunity, “Resistance means decrease in body immunity” Teacher 21.

**Students**

Almost all students felt that antibiotics are a form of “Tagdi-dawa” or “strong medicine” to be taken in special conditions. Many public school students were not aware of what antibiotics are! However, many private school students were familiar with the term antibiotic but without clear understanding. “Antibiotics are those medicines where a single tablet (probably one antibiotic) can be used for many types of sicknesses” Student 3.

For others, antibiotics are proteins which kill microorganisms and are synonymous with antibiotics. Some explained that antibiotics stop the growth of harmful bacteria in the body, so preventing infection. “Antibiotics, like penicillin, stop growth of bacteria in the body and at the same time our immune system becomes stronger to fight against those bacteria” Student 12. A few students mentioned that antibiotic resistance is a condition in which antibiotics do not have any effect even after a proper dosage is given to the patient.

**Antibiotic Use Behavior**

**Teachers**

Most teachers claimed that if they experienced fever-like symptoms, “wait and watch” was the most often adopted policy. For “plain diarrhea” without blood or mucus adults take home remedies and wait for 2–3 days before visiting a doctor. However, for children with cough, cold, fever, or diarrhea, they were more concerned. “We feel that, as parents we use any kitchen remedy or we apply something. When it comes to children we get frightened. We don’t wait for long, immediately we rush to a doctor. So whatever he gives we have to accept” Teacher 13.

This theme is further divided into subthemes as follows:

**Desire for an instant cure**

Wanting an instant cure and not taking time off from work, some teachers asked doctors for “strong medicines” which could be interpreted as prescribing antibiotics. “Patients are in a hurry to get cured and doctors have to cater to their demands. Patients feel ‘stronger’ medicines can make them get better quickly. With such demands doctors probably prescribe antibiotics” Teacher 1.

**Using old prescriptions and self-medication without prescription**

Old prescriptions are those written in the past and re-used in the case of similar symptoms. Reasons for not visiting doctors are the skyrocketing consultation fees and lack of time. Teachers can get instant relief by purchasing medicines from pharmacies or taking leftover medicines. “Those who have frequently similar kind of problems, they visit practitioners and they know that the doctor will give the same medicines to them. For example stomach upset and they know doctor will give norfloxicin, so they will take norflo for 3 days or 5 days from chemist shop” Teacher 6. “Due to fast life… We do not have time to visit doctor for common ailments especially for ourselves so we go to chemist shop and buy the earlier prescribed medicine… We are not sure whether it is antibiotic or not” Teacher 5.

**Not taking full course**

Many teachers admitted not completing antibiotic courses after getting symptomatic relief. Some said that antibiotics cause side-effects and therefore one should take less of them. “If I am prescribed to take the medicine for 5 days generally I take it for 2 days and if I am feeling okay, then I stop” Teacher 4. As parents, they were careful about completing the antibiotic course for their children but often left courses incomplete for themselves as medicines are expensive and left-over pills can be used later, saving time and money.

**Cost of medicine**

Some teachers felt that expensive medicines are more effective, reasoning that they would not otherwise be expensive and believing that cheaper local brands are not effective.

**Students**

Almost half of the students agreed that antibiotics were used by them in routine conditions like cough, cold, fever, and diarrhea. They stated that procurement of antibiotics from community pharmacists over-the-counter, without a formal doctor’s prescription, was common practice. “We usually buy medicines from chemist for diarrhea and probably he gives antibiotics” Student 22. Taking a few antibiotic tablets for 1–2 days for common cold/fever was usual practice since it provided immediate relief. No one had ever emphasized completing the course.

**Doctor–Patient Relationship**

Both teachers and students believed that dealing with the public is an important part of doctors’ duty.

**Teachers**

Teachers believed that the relationship of a doctor with his/her patient is not always harmonious and that doctors are more powerful.

**No counseling from doctors**

There is a serious lack of counseling by doctors, most teachers felt that they were not given enough time to ask about the medicines they were being prescribed, whether they required them or not, the importance of following the course completely, or whether there were side-effects, etc., “If the doctor gives assurance to you that you can wait a little, the worry of the patient will be over. Because we don’t have the knowledge, so whatever the doctor will advise, who is specialized in that field, we have to listen. Once the doctor gives that assurance that you can wait a little, the worry of the patient is over” Teacher 9.

If their doctor emphasized the importance of taking a full course, they would be more likely to adhere to the course of antibiotic prescribed. They felt that inappropriate use of antibiotics could be reduced considerably if doctors spent some effective time with patients.

**Not taking risk**

Antibiotics are prescribed so as to “avoid risks” which may
arise from lack of proper diagnosis. “Since doctors do not spend enough time with patients they end up ignoring the uniqueness of each case. Thus they prescribe antibiotics without proper diagnosis in cases like cough, cold, sore throat, etc.” Teacher 4. “Prescribing antibiotics assures the patient that he/she has been given ‘proper’ medicine. Thus antibiotics are prescribed for ‘chance treatment’ as ‘preventive medicines’ by the doctor” Teacher 1.

Patient pressure
A few teachers felt that patients may ask for medicines and that doctors prescribe “strong” medicines because they are afraid of losing patients if the latter is not quickly cured. However, others argued that they never asked for antibiotics; mentioning that though they want quick relief it does not mean that they want antibiotics.

Closed behavior of doctors
Respondents reported that where a doctor’s advice was sought, it was accepted and acted upon positively. However, doctors do not encourage questions from patients or their attendants. Questions made doctors “uncomfortable” and “offended,” which made them “closed” to their patients and in turn made patients reluctant to ask any questions. Due to this “closed” attitude people avoided visiting doctors, thereby perpetuating self-medication. Some of the teachers complained, “Delhi doctors are impatient and do not explain about the illness and the medicines prescribed… whereas in South India doctors patiently inform about the illness and the proper medication course” Teacher 3. A few teachers mentioned that younger doctors were more receptive to questions.

Dispensing doctors: Not providing prescription and name of medicines
Some doctors dispense medicines (often powders and liquids) directly, not giving a written prescription nor stating the name of the medicines to the patient. Patients are thus not sure whether an antibiotic is given. Such dispensation of antibiotics by doctors is thought to be done to enhance a doctor’s reputation since people believe that antibiotic usage leads to fast recovery.

Students
Students felt that they could not ask questions freely since this would be perceived as challenging the doctor’s authority. They felt that they did not get clear instructions from doctors on medicines like how to take them, duration, side-effects, or precautions to be taken. “I do not remember the doctor telling this is antibiotic and you have to take the full course even if you are feeling better or normal” Student 11.

Interventions and Strategies Suggested
After the discussions, teachers and students were apprised of the appropriate meaning of antibiotic resistance or AMR and practices for antibiotic usage. Following this, both groups proactively participated in offering suggestions to curtail misuse of antibiotics and to spread awareness.

Teachers
It was agreed that awareness about the appropriate use of antibiotics and AMR was sketchy and “should be elevated by educating the educated” Teacher 6. Teachers felt that by incorporating relevant information into school text, children could be trained at an early age to develop acumen to question unwarranted antibiotic prescriptions and to educate other members of the family too. They also felt that doctors should be trained on patient counseling and on how to achieve better doctor–patient interaction.

“Training the doctors to become more receptive to the queries of patients and interacting with patients could nurture a better relationship between the two” Teacher 1. “Proper counseling and …” Teacher 4. “… also spending a little time on each patient could help a doctor to know about each case which would help the doctor to prescribe symptomatic drugs instead of antibiotics as a blanket treatment for all infections” Teacher 5.

All teachers thought that information about antibiotic use and AMR should be spread as done for the polio program through slogans, billboard, posters, television programs, newspapers, etc., “Posters should also be distributed at schools for pasting at appropriate places. There should be a toll-free number in case one wants to know about antibiotics” Teacher 11. They also felt that public awareness messages should encourage patients to ask doctors questions about their diseases and medicines. Labeling antibiotics could also help to alert patients that “overuse and under use of antibiotics is hazardous.” “Antibiotics should be marked with different colors so that patients know that they are using antibiotics” Teacher 1.

Students
It was generally agreed that education on antibiotic use during school could help people to ask relevant questions from doctors about the prescription, whether any antibiotic was being prescribed, and the importance of reading the strip/bottle cover carefully in order to know what drug they were purchasing and how to take it. “The difference between viral and bacterial infection in laymen’s language, could raise awareness and reduce misuse of antibiotics… since in these conditions there is unnecessary consumption of antibiotics by all” Student 13. Information on antibiotics should be included in the Class 10 syllabus so that it becomes a part of mandatory learning.

Awareness about antibiotics, its uses and misuses, could be spread through posters distributed in schools, mentioning what common diseases do not need antibiotic treatment. Awareness could also be spread through mass media including television advertisements and magazines popular among students like “Cricket Samrat” and “India Today.” Students conceded that antibiotics should be cautiously dispensed and prescribed, perhaps according to stricter rules, but that banning them (from over-the-counter use) would not be a solution owing to their massive utility.

Discussion
This is one of the few qualitative studies from developing countries that have studied the knowledge and perceptions about antibiotic use and antibiotic resistance among high school students and teachers. Our study shows that students and teachers have poor knowledge and perception about antibiotics, their uses, and resistance. Antibiotics were used by both groups for mild viral conditions often directly purchased from pharmacies without a valid prescription or taken from

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left-over previous purchases as found in Jordan in an Iraqi community. In our study, another study has shown poor knowledge and irrational use of antibiotics in a survey of high school and university teachers in Iran. It is suggested by other researchers that perceptions impressed upon children due to wrongful use of antibiotics by parents and/or peers lead to self-medication among adolescents, augmenting irrational antibiotic use.

A second important finding from this study is the perception by teachers and students of poor doctor–patient relationships and its implication for the inappropriate use of antibiotics. Both groups were not satisfied by the information provided by doctors on the use of medicines and antibiotics. Due to this poor relationship, many patients do not visit the doctor and take medicines directly from the pharmacy. Poor antibiotic use resulting from ineffective doctor–patient relationships has been observed elsewhere. In Iceland, an unstable doctor–patient relationship due to lack of continuity of care, patient pressure in a stress-loaded society, and the doctor's personal characteristics, particularly zeal and readiness to serve were cited by GPs as important reasons for “nonpharmacological” antibiotic prescribing. A review on time and the patient–physician relationship recommended that to make the most of whatever visit time is available the medical training must contain improved instruction in doctor–patient relationships and that training is extended to practicing physicians.

A third important finding from our study is interest shown by school teachers and students to play a role in raising public awareness concerning antibiotics and AMR as has been found elsewhere.

Both teachers and students in our study emphasized the importance of empowering the public with regard to antibiotic literacy and suggested strategies for community-based awareness programs, through mass media and popular sources of general awareness, that have been implemented elsewhere. The "Know your Medicine Campaign" in Malaysia aims to educate and prepare the public with knowledge and skills to understand their medicines and to use medicines rationally. Several national media campaigns in Belgium aim to alert the public to the problem of AMR as does the e-Bug project, spanning ten countries, which includes classroom teaching materials, games, and a website designed to increase knowledge of infectious diseases and antibiotic treatment among school age children. These interventions appeared to be successful since there was a decrease of 26.5% in community-based antibiotic prescribing between 2002 and 2007 in France, which participated in the European e-Bug school project.

This study has some limitations. It was undertaken in West Delhi and the views of Delhi students and teachers may not be representative of the students and teachers as a whole. Common themes did emerge from these five FGDs, and thematic saturation was satisfactorily achieved; yet caution should be taken in generalizing the findings. Nevertheless, this is probably the first in-depth qualitative study in India exploring the knowledge, attitudes, and behavior of high school teachers and students concerning the antibiotic use. The study showed that teachers and students were receptive to learn about antibiotic use and AMR and had practical suggestions on how to improve the rational use of antibiotics. Thus, educational messages targeting schools could well be effective in reducing inappropriate use of antibiotics in the community.

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Conflicts of Interest
There are no conflicts of interest.

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