Original Research

Knowledge and behavior of consumers towards the non-prescription purchase of antibiotics: An insight from a qualitative study from New Delhi, India

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Abstract

Background: In Low-and Middle-Income Countries, including India, consumers often purchase antibiotics over-the-counter (OTC) from retail pharmacies. This practice leads to the inappropriate use of antibiotics in the community which is an important driver for the development of antimicrobial resistance. A better understanding of consumers' views towards this grave public health concern is critical to developing evidence-based intervention programs for awareness among the general population.

Objective: To explore knowledge, practice and, behavior of consumers towards antibiotics, antibiotic use, antimicrobial resistance, purchasing behavior of consumers for antibiotics, and to gain insight which will help in developing evidence-based policy interventions.

Methods: 72 in-depth consumer interviews were conducted in all 11 districts of the National Capital Territory of Delhi. The qualitative data were analyzed using thematic analysis.

Results: Our study found that retail pharmacies were the first point of consultation for common ailments for patients/consumers once home remedies failed; they were largely unaware of the threat of antimicrobial resistance. Consumers' knowledge of antibiotic use and about antimicrobial resistance was low, they used old prescriptions, and bought antibiotics OTC to save time and money. Despite the presence of regulations constituted to regulate the sale of antibiotics by the Government and the implementation of national campaigns, the practice of self-medication and behaviors such as OTC purchase, non-adherence to prescribed antibiotics was prevalent. Consumers perceive that antibiotics provide quick relief and accelerate the curing process and retail pharmacy shops try to protect their retail business interests by honoring old prescriptions and self-medication for antibiotics.

Conclusions: The lack of awareness and insufficient knowledge about what antibiotics are and issues such as antimicrobial resistance or antibiotic resistance resulted in misuse of antibiotics by consumers. Limited access to public healthcare and affordability of private healthcare are factors that contribute towards the self-medication/OTC purchase of antibiotics. The regular misuse of antibiotics through irrational use reinforces the need for strong enactment of strategies like continuous community awareness campaigns. Mitigation efforts should focus upon educating consumers continuously and sustainably for the understanding of antibiotic misuse, antimicrobial resistance, and promote better compliance with regulations.

Keywords

Anti-Bacterial Agents; Drug Resistance, Bacterial; Self Medication; Nonprescription Drugs; Prescriptions; Public Health; Evidence-Based Practice; Pharmacists; Pharmacies; Commerce; Developing Countries; Qualitative Research; India

INTRODUCTION

Antimicrobial resistance is a significant global public health threat of the 21st century.[1] Antimicrobial resistance decreases the efficacy of antimicrobials in the prevention and treatment of infectious diseases. It has been estimated that the infections from resistant bacteria will surpass malignancies as the leading cause of death by 2050, and may cost the global economy USD100 trillion.[2] The burden of antimicrobial resistance in low and medium-income countries (LMICs) is assessed to be three times higher than that of developed countries.[3] In India, 58,000 deaths occur annually among neonates due to infections caused by multi-drug resistant microorganisms.[4] The main driver for the increase and spread of antibiotic resistance is inappropriate/overuse use of antibiotics. Misuse of antibiotics has put unnatural selective pressure on bacteria that potentiates the development of antimicrobial resistance.[5,6] According to the WHO, over 50% of the antibiotic prescriptions worldwide are inappropriate with two thirds of antibiotics accessible at the pharmacies being used for self-medication and the easy over-the-counter (OTC) access to antibiotics which is common in LMIC's.[7,8] Inappropriate antibiotic consumption is a major contributor to antimicrobial resistance in the community. Use of antibiotics causes a selective pressure by killing susceptible bacteria and allowing antibiotic-resistant bacteria to survive and multiply. Repeated exposure of pathogenic bacteria to antibiotics causes increased selective pressure which results in higher prevalence of antimicrobial resistance. Thus, self-medication and easy access to antibiotics without prescription is one of the major concerns for inappropriate and overuse of antibiotics in the community.

India is one of the largest consumers of antibiotics, and sales of antibiotics continue to increase rapidly.[9,10] In 2010,

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India was the world's largest consumer of antibiotics for human health at 12.9 x 109 units (10.7 units per person).The inappropriate use of antibiotics has been documented and the consumption of higher-end antibiotics is high and increasing in India.[11] According to World Bank data of 2016, in India, there are 0.70 physicians per 1000 individuals; in comparison to the United Kingdom that has 2.81 and 2.45 trained health providers in the USA.[12] The problem is a complex one with rural-urban differentials of health providers in India. Only 26% of the doctors serve in villages that account for 70% of the total population in the country.[13,14] Given this situation, Indian retail pharmacy shops become the key source of acquiring antibiotics OTC, often without a valid prescription. Despite the existence of regulations banning such practices, they continue to flourish, further contributing to antimicrobial resistance.[15]

A recent systematic review done from the low-and middle-income countries and a few studies from the developed countries like from Australia, Italy, North Carolina have revealed knowledge gaps concerning antibiotic use among general population.[16-19] These studies have indicated that the behavior of the general population is skewed towards the random use of antibiotics. These behaviors are prevalent in many LMICs – driven by the trend that antibiotics can be purchased as OTC from retail pharmacies.[20,21]

India has two relevant and important Acts − the Drugs and Cosmetics Act (DCA), 1940, and the Drugs and Cosmetics Rules (DCR), 1945. As per these documents all antibiotics are prescription drugs and comes under schedule H.[22] Amendment to schedule H was made in 2014 to include the second and third generation of antibiotics and it is called schedule H1, which requires pharmacists to maintain a separate register for sale of these antibiotics with a copy of the prescription.[22] Schedule H1 lists 48 drugs, the majority of which are antibiotics. This Schedule was added to the existing DCR in 2014 to curb the widespread practice of consumer purchasing antibiotics without a valid prescription from retail pharmacies. Furthermore, to create public awareness on the rational use of antibiotics, the Ministry of Health and Family Welfare (MoHFW), Government of India developed the 'Medicines with the Red Line' campaign. This campaign was launched in February 2016.[23] The key message of 'Medicines with the Red Line' was to highlight that this medicine is an antibiotic and a prescription drug. This campaign was done to curb self-medication and to create awareness about the dangers of misusing antibiotics. However, despite the presence of regulation and efforts of the Government of India, the OTC sale of antibiotics is prevalent in the country.[24] There is no study to show that the message of Red Line campaign has reached to the consumers and the general population have understood that the medicine having Red Line/Box is a prescription drug and not to be taken without doctor's advice.

Though there are many studies on misuse of antibiotics in the community but there is paucity of data on consumer behavior and knowledge regarding antibiotic use and antimicrobial resistance. Therefore, this study was designed to explore the knowledge, practice and behavior of consumers about antibiotics, and antibiotic purchasing behavior in general. A better understanding of consumers' views towards this grave public health concern is critical to developing evidence-based intervention programs for awareness among the general population. There are a few studies conducted earlier in the National Capital Territory (NCT) of Delhi that showed higher use and inappropriate use of antibiotics in the community.[24-26] Therefore to investigate the multi-layered problem related to antibiotic use and antimicrobial resistance, in-depth interviews with consumers living in the NCT of Delhi was conducted. The study also tried to find the awareness of consumers about the Red line campaign for antibiotics.

The main objectives of the study were to:

(1) Explore knowledge, practice and, behavior of consumers towards antibiotics, antibiotic use and antimicrobial resistance;

(2) Explore the driving factors associated with antibiotic use and purchasing behavior of consumers for antibiotics.

METHODS

Study design and study setting

The study was conducted in the capital state of India, National Capital Territory (NCT) of Delhi which is divided into 11 districts.[27] The NCT covers an area of 1,484 square kilometers (573 sq. mi). According to the 2011 census, Delhi city population was 11 million and estimated population by 2021 is 30.5 million.[28] A qualitative research design was used to collect data about consumers' understanding of antibiotics, antimicrobial resistance and practices related to the purchase of antibiotics. The methodology employed was semi-structured guide to conduct in-depth interviews. The in-depth interviews were conducted with 72 consumers in ages 18 to 70 years across all 11 districts of Delhi. The sample is characteristic of demographic distribution in the state. In each district 5-7 interviews were conducted, post which saturation in response was noted. Based on this finding the sample size for each district of 5-7 was used to arrive at the total sample size. Six consumers refused to participate in the study and one left the interview mid-way as the subject did not interest him. Consumers who participated in the interview were purposively selected from diverse age, income groups, gender and occupations to achieve study objectives. Consumers were categorized into three different income settings i.e. low income, middle income and upper-middle-income groups to understand differences in their knowledge and behavior concerning antibiotics and antibiotic use. The income group of the consumers was classified based on their occupations and place of residence (where the interviews were conducted).

Development of interview guide

A semi-structured interview guide was prepared by a team consisting of two social scientists, research fellow, community medicine specialist and a pharmacologist working in the area of antibiotic use and antimicrobial resistance (Online appendix). All the five team members are female, with the following characteristics: (a) has more than 30 years of teaching and research experience, (b) has

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more than 19 years, (c) 8 years, (d) three years and, (e) did internship for her post-graduation. The guide was prepared to collect qualitative data on the practice of purchase of antibiotics, knowledge about antibiotics and issues related to antibiotic resistance and regulations for antibiotic purchase from retail pharmacies. Taking cognizance of the study objectives and previous studies, broad areas of knowledge were outlined. These broad areas of knowledge were relevant to answer research questions. Questions were then developed within these broad areas to tap into participant's experiences and perspectives. The interview guide was reviewed multiple times within the research team before it was pilot tested with target participants. The interview guide was prepared in English and later translated into Hindi language by a certified translation agency. The interview guide was pilot tested among ten consumers in Delhi, and was modified iteratively according to the results of the field test. We identified any possible flaws during pilot testing of interview guide that required adjustment and clarification in the guide/question. Pilot phase interviews also helped the interviewers to realise that by the end of interview they need to be sure that they have covered all the domains and questions for the in-depth interview. The guide was kept flexible including open-ended questions to encourage exploration of domains that derived from the interactive sessions. The Interview guide focused on the following (predefined) domains: namely - practice and behavioral practices related to buying medicines for common ailments, knowledge about antibiotics and practice of buying antibiotics with or without prescription, knowledge about antimicrobial resistance / antibiotic resistance, knowledge and regulations about antibiotic purchase and knowledge about prescription drugs (Schedule H and H1 regulation) and the Red-line mark/box on the label of the medicine.

Data collection

The interviews were conducted between January 2020 to March 2020 in bilingual (English and Hindi) language by two of the researchers using a semi-structured interview guide. Consumers were selected based on purposive sampling (as mentioned above) and included in the study when they consented to participate. The snowball sampling method was used, wherever possible, to identify consumers in the community. In concurrence with ethical considerations, prior verbal or written consent was taken from the consumers and interviews which were audio-recorded. Field notes were also taken by one of the interviewers. A rapport was established with the participants prior to the commencement of interview. Participants were not earlier known to the research team. Interviewers were given training before data collection by the senior research team and ASL had accompanied the two interviewers for two pilot interviews. Most of the interviews were conducted from the common public areas like market places, while some of the interviews were conducted at the residence of the participants. No one else was present besides the participant and interviewers. Interview duration ranged from 15-30 minutes with each respondent. Data from each district was collected till data saturation was obtained. Participants confidentiality was maintained while conducting the interviews, analysis and reporting.

Data analysis

In the initial phase of the fieldwork, the pilot interview recordings were transcript verbatim and coded for analysis. These initial findings aided in iterative re-working of interview guides for language appropriateness and to probe deeper into the responses by the entire team members. Similarly, interview recordings of the study were transcribed verbatim and translated into English in MS Word for the analysis. The data was coded in MS Word and excel sheets were used by two researchers independently and subsequent reviews were done for thematic analysis. Some of the coding was done manually using blank sheets and sticky notes. Responses were thematically coded by two researchers for themes and sub-themes. As an initial step to aid familiarization, the research team read and re-read each transcript, before carefully coding each transcript line-by-line. The coding process was both inductive and deductive, as some themes were derived inductively, while others deducted from the data. The authors made use of a coding table with four columns. The entire qualitative data in the textual form was placed in column number 2. Column one was used for extracting codes out of the data and column three was used to enlist sub-themes emerging from the codes. Similarly, Column four was used for listing out themes that emerged from this process of going back and forth between the codes and sub-themes. Data validation was done before finalizing the themes and sub-themes. Data validation was done after completion of each in-depth interview, researchers (field investigators) checked the interview guide to ensure participants responded to all questions. At the end of each day during data collection, researchers double checked the recordings and details of each interview to ensure clarity of recordings and quality of responses. A senior researcher randomly called few participants over phone to cross-check that interviews were conducted. None of the interviews were repeated. Post transcription of the data, the data was reviewed and checked for accuracy and consistency with the raw data. Post translation of the data (both Hindi and bilingual), the data was reviewed by researchers for translation accuracy and consistency. Each interview data was then coded independently by two researchers in MS Word. Researchers deliberated on any diverging issues in coding and arrived at consensus. In few instances where consensus could not be achieved, opinion of senior researchers was sought. Once the entire data was coded, the team of researchers (including the three senior researchers) reviewed and revisions were made wherever necessary to mitigate interpretative bias. All major themes and sub-themes were agreed with discussion and consensus of the entire team. A combination of both deductive and inductive approaches were used in coding the data.[29]

The researchers arrived on common themes and sub-themes in consensus to minimize the coder bias. Transcriptions were not returned to the participants and participants did not provide feedback on the findings. Authors used the consolidated criteria for reporting qualitative research (COREQ) checklist that helped them in study methods, context of the study, findings, analysis and interpretation.[30] Considering the number of qualitative interviews conducted, the data were also analyzed from a quantitative perspective, and an excel sheet of common

Table 1. Demographic details of consumers of Delhi/NCR

Characteristics (N=72)	N (%)
Gender	
Males	41 (57)
Females	31 (43)
Age group	
15-25 years	15 (21)
26-34 years	16 (22)
35-45 years	14 (19)
46-55 years	14 (19)
Above 55 years	13 (18)
Occupation	
Daily wage worker	12 (17)
Small scale business	10 (14)
Government/private Employee	27 (38)
Student	11 (15)
Housewife	7 (10)
Others	5 (7)
Income group	
Low income group	16 (22)
Middle income group	48 (67)
Upper middle income group	8 (11)

findings/reporting was prepared for quantification. Quantitative analysis of the qualitative transcripts helped in understanding trends regarding consumers' antibiotic use and behavior.

Ethical considerations

Ethical approval for the study was obtained from the Ethical Committee of Vallabhbhai Patel Chest Institute (VPCI/DIR/PS/IHTC/2018), Delhi University, Delhi and AIPH, Amity University (AUUP/IEC/2019-MAR/04), Noida (U.P.). All participants in the study were informed that their participation was voluntary and provided with a clear explanation of the purpose and procedure of the study. Protocols were established to ensure the anonymity of all the participants. Each participant provided either a written or verbal consent before proceeding with the interview. Most of the participants were reluctant to sign the consent form, but provided oral consent.

RESULTS

Consumers' health-seeking behavior for common ailments

A total of 72 consumers were interviewed out of whom 57% of the respondents were male and 43% were females. The ages of consumers interviewed ranged from 18-70 years. Highest proportion of the consumers were salaried workers (38%), 17% were daily wage workers, while 14% of the consumers were independent or had small-scale businesses. Further, 15% of the consumers were housewives, 10% were students and the remaining 7% of consumers were categorized as others (i.e. retired and engaged in other occupations). In terms of income, 67% of the consumers belonged to the middle-income group, 22% and 11% of the consumers belonged to low and upper-middle-income groups respectively (Table 1).

Using reflexive thematic analysis as propounded by Clarke and Braun (2006), five themes with corresponding sub-themes were identified (Table 2). The participants' quotations are presented to illustrate the findings and each of the quotation was identified as participant number. There was consistency between the data presented and the findings.

This theme describes participants' health-seeking or medication-seeking behavior for common ailments like cold, cough, flu-like symptoms or acute diarrhea and their actions when they fall sick.

Interviews with consumers identified that the majority of the consumers first try some home remedies or self-medicate (using leftover medicines). Next they reach out to their neighborhood retail pharmacies. Almost 88% (63 out of 72) of the consumers admitted purchasing OTC medicines either as advised by a pharmacist at a retail pharmacy or they self-medicate using previous or outdated prescriptions. From this subset of 63 consumers 70% of consumers reported self-medication, 54% reported reliance on pharmacist's advice and 45% reported seeking pharmacist's advice based on an outdated prescription; the aim was to get OTC medication from pharmacies for common/non-serious ailments. (Table 3)

> "If it is a minor illness then we take it (medicine) from a chemist (pharmacist) otherwise we visit the doctor." (C-14)

> "It depends actually for cold and all we take medication from a pharmacist (retail pharmacy shop)." (C-41)

Common OTC medicines purchased by consumers comprise paracetamol (Acetaminophen), acetylsalicylic acid, propyphenazone+paracetamol, azithromycin, ofloxacin, cetirizine, amoxicillin etc. for common ailments like headache, fever, or the common cold. Many consumers also reported similar purchase patterns of antibiotics as

Table 2. Themes and sub-themes derived through systematic thematic analysis of the interviews

Theme	Sub-themes
1. Consumers' health-seeking behavior for common ailments	(i).The first point of consultation (ii). Commonly purchased OTC medicines including antibiotics
2. Consumers' knowledge and practices towards antibiotics	(i). Knowledge regarding antibiotic use (ii). Behavioral practice related to antibiotics use
3. Consumers' awareness of current regulations regarding antibiotic purchase from retail pharmacies	(i). Knowledge of existing regulations for antibiotics (ii) Awareness and misunderstanding about the Red Line labelling of antibiotics
4. Factors contributing to over-the-counter (OTC) purchase of antibiotics	(i). Self-medication among consumers (ii). Easy accessibility of retail pharmacies (iii). Pharmacist's commercial interest pushing the sale of non-prescribed antibiotics (iv). Poor accessibility to public healthcare facilities (v).High consultation cost at private healthcare facilities
5. Consumer's knowledge of antimicrobial resistance (AMR)	(i). Awareness about antibiotic/antimicrobial resistance (ii). Knowledge about the reasons of developing or antibiotic/antimicrobial resistance

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Table 3. General health-seeking behavior, and understanding, awareness about antibiotics among consumers of Delhi

Characteristics (N=72)	N (%)
Reported Purchase of OTC medicines	
Yes	63 (88)
The common method of taking OTC medicine (N= 63)	
Pharmacist advice/ Symptomatic treatment	34 (54)
Self-medication	44 (70)
Old-prescription based medication	29 (46)
Knowledge about antibiotics (N=72)	
Heard of antibiotics	55 (76)
Aware of the correct definition of antibiotics	9 (12)
Ability to name 1 or more than 1 antibiotics	24 (33)
Practice towards antibiotics (N=55)	
Reported Purchase of OTC antibiotics	27 (49)
Reported incomplete consumption of antibiotics	29 (53)
Knowledge about antimicrobial resistance (AMR) or antibiotic resistance (N=60)	
Heard of antimicrobial resistance (AMR) or antibiotic resistance	19 (32)
Aware of the correct definition of AMR	10 (17)
Awareness about the red-line campaign of government for Schedule H1 drugs (N=66)	
Seen red-box/line over medicines	12 (18)
Aware of the correct implication of red-box over medicines	3 (5)
Misconception about red-box indicating non-veg content of the medicine	7 (11)

OTC medicines. Thus, consumers' knowledge of antibiotics was further explored through interviews.

> "I take antibiotic in case of infection like when cold and fever is together than with paracetamol I take one Amoxicillin" (C-69)

Consumers' knowledge and practices towards antibiotic use

Overall consumers' knowledge and understanding of antibiotics were found to be weak and most of the consumers were not aware of the correct usage of antibiotics. Consumers have many misconceptions about antibiotics which are likely to influence their user behavior.

Consumers had minimal understanding of antibiotics, though 55 out of 72 (76%) of the consumers reported that they have heard of the term 'antibiotics'. All the consumers from the upper-middle-income group have at least heard of antibiotics, while only some of the consumers from the low-income group were familiar with the term. Further, their understanding of antibiotics varied according to their socio-economic stata background and place of residence (urban or peri-urban). However, on being asked about what an antibiotic is, only 12% were able to define antibiotics as medicines used for bacterial infection, though around 35% of the consumers mentioned medicines for treatment of infections. Out of 55 consumers who had heard of antibiotics, 27 (49%) reported OTC purchase of antibiotics. Thereby, implying that half of the consumers who were aware of antibiotics, seek OTC antibiotics from pharmacies. About 35% (25) of the consumers had clarity about antibiotics to be used for infection but most of the consumers i.e. 65% (47) were confused before defining it. Remarkably, even those consumers (12%) who had correctly comprehended that antibiotics are used in case of bacterial infections but still said it was used to treat illnesses like viral fever and diarrhea.

> "Antibiotics are medicines which I think kill bacteria…like we take in case of cough and cold or viral fever and basically, it reduces bacterial infection" (C-12)

Furthermore, most of the consumers perceive that antibiotics provide quick relief and accelerate the curing process, while some of the consumers considered it as a supplementary energy tablet. Few of the consumers also specified that antibiotics are mandatory medicines that are given by doctors along with routine medicines. There is a notion among consumers that antibiotics are 'strong' medicines and there are side-effects with antibiotics. This misconception leads to an incomplete consumption pattern. Antibiotics are perceived as a 'quick fix' for all ailments by many consumers.

> "Antibiotics, they (pharmacist/dispenser at pharmacy shop) give when we want quick relief. Like if we tell them that children are having exams so for quick relief then they give (antibiotics)." (C-66)

> "Like if we take antibiotics, mostly these medicines are very strong doses, so sometimes it suits sometimes it doesn't." (C-49)

Two very common practices that consumers reported concerning antibiotic usage are:

- Incomplete consumption and not purchasing full-course of antibiotics − Consumers demonstrated non-adherence to prescribed antibiotics by either not purchasing the full course prescribed or by incomplete consumption of the prescribed/purchased dose. Interestingly, many consumers reported purchasing antibiotics for only one or two days instead of buying the complete dosage. They mentioned that they buy an incomplete course as they perceive two days' dose to be sufficient for them. Also, there are financial constraints attached to consumer antibiotic purchasing habits. One of the consumers considered that even a single dose of antibiotics like Azithromycin is enough for him for getting cured. As contrast, a few of the consumers also reported taking the complete course of antibiotics. Further, on being questioned whether they take the complete course of antibiotics or not, 29 of the consumers (53%) reported taking an incomplete course

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of antibiotics as prescribed by a doctor or pharmacist; this applies to self-medication as well.

> "I think a single dose is enough (of azithromycin) for me, it was initially prescribed to me by the doctor, and then I got to know this medicine is used in this particular symptom, so now I take it myself." (C-10)

- Inconsistent follow-up visits to doctors- Many consumers reported inconsistent follow-up visits to doctors. They reported that they usually just do not go for follow-up visits. This is because consumers perceive that they have been 'cured' and there is no need for ensuing visits. Consumers reported that they do so to save money and time. Surprisingly, one of the consumers mentioned that he was expected to go for subsequent doctor visits but he didn't go and instead he took the same medicines prescribed during his first visit for two years; buying the medicines from his regular pharmacy shop without a valid prescription. At a later stage, he realized that the medicine he took for two continuous years was an antibiotic and it was prescribed to him only for a much shorter duration. This case demonstrates inconsistent follow-up visits to doctors; which leads to over-or under-consumption of antibiotics and pharmacy shops (manned by pharmacists or his/her staff who is generally not trained in pharmacy) readily dispensing antibiotics.

> "Like I got operated so the doctor prescribed me antibiotics for some time. Due to some reasons, I could not visit the doctor again so I took that antibiotic continuously for 2 years (thinking it is similar to any other medicines). But due to those antibiotics and steroids, my immunity has gone down; I have become weak from inside." (C-66)

Consumers' awareness about current regulations regarding antibiotic purchase from retail pharmacies

The regulations about antibiotics are formulated by the government to encourage the prescription-only purchase of antibiotics among consumers. This theme identifies the awareness and understanding of consumers about regulations about antibiotics.

Most of the consumers were unaware of existing directives for the sale and purchase of antibiotics which comes under prescription drugs (Schedule H and H1). None of the consumers mentioned the term 'schedule drugs' or prescription drug for antibiotics, rather they mentioned that they seek antibiotics without a prescription. Surprisingly, one of the consumers was able to comprehend the difference between antibiotics and OTC drugs. However, the majority of the consumers do not perceive any difference between antibiotics and other OTC medicines and there is low awareness that antibiotics should be purchased only with a current/valid, doctor's written prescription.

> "Difference (between OTC drugs and prescription drugs) as such is not there but what I understand is that if the government of India bans some medicine then that medicine will be available only on the prescription of a doctor because there are some harmful effects of it." (C-64)

Consumers were asked whether they have seen any red box or line on certain medicines or antibiotics, however, very few reported seeing any such indications. Despite the efforts of the government to publicize this information, only 12 of the consumers had seen this red-box over antibiotics, and out of those only three of the consumers were aware of their correct meaning. Interestingly, 11% (7) of the consumers mentioned that red-box or line on certain medicines/antibiotics represent non-vegetarian content of the antibiotics/medicines.

> "Red mark is there over medicines for vegetarian or non-vegetarian demarcation." (C-55)

> "I know that some medicines have a red symbol which indicates …have some non-vegetarian constituent." (C-66)

Factors contributing to over-the-counter (OTC) purchase of antibiotics

Over-the-counter sale/purchase of antibiotics implies the sale of prescription drugs i.e. antibiotics without the prescription of a doctor or medical practitioner. In this theme, we have derived various factors from the consumers' interview which influence the OTC purchase of antibiotics among them. In the community, the practice of pharmacists and healthcare delivery factors determine the OTC purchase behavior. Also, this theme highlights some practices and behavioral tendencies of consumers that contribute to the OTC purchase of antibiotics.

Self-medication, either through reliance on old-prescriptions or through consulting family or friends is a major cause of OTC purchase of antibiotics. Consumers reuse doctor's previous prescriptions and start seeking antibiotics on their own, especially in the case of similar symptoms for which the prescription was given in the first place. Most of the consumers explicitly stated that initially antibiotics were prescribed by the doctor, but when they identified a repetitive pattern – saw that the same antibiotic being prescribed by the doctor − they started purchasing it directly from pharmacies and taking the antibiotics on their own. In some cases, consumers try to reuse an outdated prescription from a medical practitioner to save time and money. Consumers mentioned antibiotics like azithromycin, amoxicillin, ofloxacin, norfloxacin + tinidazole + lactic acid bacillus, ornidazole, metronidazole which they seek directly from the pharmacies like any other medicines.

> "If I have a throat infection or something related to it, then I take azithromycin and if it is diarrhea or some flu, then I take O2 (ofloxacin+ornidazole). So, these are the medicines/antibiotics that I know of and take. In addition to these, I know a few other medicines/antibiotics but I am not frequently taking them." (C-48)

Pharmacies are the first point of treatment-seeking among consumers − either through self-medication or through reliance on pharmacist's advice. Many consumers mentioned that in case of minor ailments like cold, cough, fever or diarrhea, etc. a pharmacist's (i.e. person available at the pharmacy shop, who may not be trained in pharmacy) medicines are effective, so they don't feel the need of taking medical professional consultation. However,

only very few consumers understand that pharmacists/dispensers are not the correct authority to prescribe medicines; despite this knowledge, they often get medicines (including antibiotics) from them. Many consumers specified that they can get any medicines/antibiotics without a prescription from pharmacists whom they know.

> "We are staying in this area from such a long time, so chemists (retail pharmacies) of nearby they give us medicines as they know us." (C-28)

Consumers mentioned that pharmacists push OTC sale of antibiotics or any other medicines to boost their business. According to consumers, pharmacists are also doing business like any other trade and thus, they also try to increase their sales for their benefit. Some of the consumers specified that many times pharmacists try to sell some other medicines along with the prescribed medicines since they profit from such sales. Thus, pharmacies are often profit-oriented with less respect for ethics. Consumers also mentioned that pharmacists can push the sale of non-prescribed antibiotics because consumers trust them.

> "They (Pharmacists) also have to earn money for themselves, if you will go to a pharmacy and ask for 10 medicines he or she will give you 11 and they will emphasize that this additional one is very good and you should take this one too. Why should he lose his business? You are the purchaser from them that's it." (C-40)

Consumers, especially from low and middle-income groups, emphasized that poor access to public healthcare facilities from where they are supposed to get free treatment resulted in their reliance on pharmacy shops. Consumers mentioned that they do not wish to spend money in private healthcare facilities for common non-serious illnesses; however, the non-availability of universal public healthcare facilities encourages them to seek medicines/antibiotics from retail pharmacies. Further, they stated other factors like non-availability of doctors, lengthy queues and long waiting hours in public hospitals reduce consumer's motivation to visit public healthcare facilities.

> "If we will go to government hospitals to seek medicines for minor ailments like cold or cough; then we have to wait in queues and our daily wage will be affected, so it is better to take medicine of INR 10 - 15 (USD 0.1 - 0.2) from the medical store (pharmacy). (C-4)

The cost of healthcare in the private sector is a major driver of consumers' reluctance to consult a private practitioner. Higher consultation fees in the private sector even for minor illnesses, induces OTC medicine/antibiotic-seeking behavior of consumers; leading to the misuse of antibiotics. Further, consumers perceive that whatever medicine doctors are prescribing (at a cost of INR 500 to 800 (USD 8 - 11), including medicines and consultation) can be sought from pharmacists at cheaper rates.

> "In case of a minor problem, it's better to take medicine/antibiotic from the chemist (pharmacist), instead of giving Rs.500 to 800 to the doctor." (C-28)

Consumer's knowledge of antimicrobial resistance

This theme highlights key findings on consumers' knowledge and its consequential effect on antimicrobial resistance. The theme elucidates perception of consumers towards developing resistance.

Less than one third of the consumers surveyed had heard of the term antimicrobial resistance, neither were they able to define the term antimicrobial resistance. Most of the consumers were of the view that some medicines are not very much effective over period of time as maybe their body develops resistance against those medicines. Thus, there is a misconception among the consumers that the body develops resistance against medicines (antibiotics).

> "Like if you take antibiotics even for small things, your body develop resistance to the antibiotics, means that they will not affect your body anymore if you keep on taking it." (C-51)

Very few consumers knew that misuse of antibiotics (both over/ under consumption) allows the microbe to develop resistance against the antibiotics and, therefore, there is a need to adhere to prescribed antibiotic duration. Some of the consumers were able to communicate that continuous administration of antibiotics leads to the development of resistance. They were of the view that since doctors prescribe antibiotics for common ailments, it should be good medicine and people need to take it.

> "They (Doctors) prescribe it for everything even in case of normal fever so no harm taking few doses of antibiotics." (C-70)

DISCUSSION

Our research provides insights into the behaviors of urban dwellers related to treatment seeking for common ailments, sourcing and use of medication including antibiotics for these ailments and understanding on use and misuse of antibiotics and antimicrobial resistance. The study identified the practice of self-medication among consumers through reliance over old-prescription. Consumers even rely over pharmacies as their first line of treatment in case of minor ailment and seek symptomatic advice from pharmacists. The easy accessibility of retail pharmacies in the study site makes it easy for consumers to seek antibiotics, prescription drugs as OTC drugs. In India, it is not always a trained pharmacist is dispensing medicines at retail pharmacy shops, rather many-a-times untrained staff employed at pharmacies deal with patients. These staff learn about dispensing on the job. Non-pharmacists dealing with patients is one of the major concerns for inappropriate dispensing of antibiotics as these non-pharmacists are not aware of antimicrobial resistance or appropriate use of antibiotics.[31] The major reasons quoted by the consumers to seek antibiotics directly from pharmacies without a prescription are: limited public healthcare services, costly private healthcare services and behavioral practice of self-medication. Pertaining to the knowledge and understanding towards antibiotics, it was identified that majority of the consumers are not informed about correct usage and definition of antibiotics. Consumers found to be perceiving that body develops

resistance against medicine and therefore, there is a misconception in the community that prolong consumption of antibiotics (or taking complete) course is not a good practice. The lack of awareness on antimicrobial resistance emerged as one of the critical factors in casual approach to consuming these. One of the remarkable finding of our study is misconception of a few consumers towards 'Red-Line Campaign' or initiative of government as they consider Red line for indicating non-vegetarian content of the medicine.

Our findings are supported by observations made by other researchers. Several studies from developed and developing European countries reveal self-medication by people for common ailments like sore throat, fever, common cold or cough and diarrhea as well as use of non-prescribed antibiotics.[5,18,32-34] This self-medication practice is common either through self-knowledge or through reliance on over a previous-episode prescription.[35] As noted in our study, use of old prescriptions was common among consumers in these studies as well as it saved time and money. Closer to home, another study covering pharmacists in Delhi also reported old-prescription based sale of antibiotics.[24] Preserving antibiotic prescriptions from doctors by consumers creates a problematic reservoir of antibiotics which leads to irrational consumption in the community.[36] Hence, this finding supports the need for reformation of regulatory policy at the national or country-specific level to stop the use of old-prescriptions at pharmacies. A mandatory guideline is required to explicitly define the validity of a prescription or to reduce the validity of the prescription. The present study also explored the predictors of self-medication and preferential choice of self-medication among consumers. The findings suggest the reason for self-medicating by using antibiotics (merely because it may have been effective in a previous episode, urgency of use (due to time constraints), financial reasons and behavioral tendency/habit. Our findings corroborate the results of a study conducted among university students in the UAE where self-administration of antibiotics was practiced for similar reasons.[37] Studies from developing nations like China mainly reported convenience and cost saving, and South Jordan reported previous positive experience with the antibiotics and difficulty reaching physician especially for low-income population as prevalent factors in the practice of self-medication among consumers.[38,39]

Our study also identified the lack of comprehensive knowledge and poor understanding of antibiotics among consumers. Consumers are unaware of correct usage and proper administration of antibiotics, rather they have misapprehensions about antibiotics. Similar findings were quoted in a study from another developing nation Cameroon (in Central Africa) where the vast majority of the population (88%) reported antibiotics use for the treatment of a variety of ailments.[5,18,40] The findings from other Indian states of West Bengal, Odisha and Haryana are also consistent with our finding wherein consumers lack comprehensive knowledge about antibiotics.[41-43]

Also, our study identified the perception of consumers that antibiotics are given for all ailments or as 'quick relief' drugs which can speed up a person's recovery process. A qualitative study of the social determinants of antibiotic use among 20 community members in Haryana, India also revealed that consumers perceive antibiotics as a necessary medication that can be used for the treatment of any disease.[43] Another study from Malaysia also reported similar findings where antibiotics were considered treatment drugs for viral diseases as well among consumers.[44]

Knowledge and understanding of consumers influence their practice towards antibiotics in the community. The non-adherence towards medication (prescribed antibiotics) is another factor that is responsible for the inappropriate consumption of antibiotics among consumers. Consumers do not follow prescribed antibiotic treatment regimen and often skip proper dosage or buy incomplete doses from pharmacies. This practice among consumers leads to over or under consumption of antibiotics.[45] A qualitative study conducted in 2017 among Australian consumers showed that non-adherence to prescribed antibiotics was frequent among consumers.[36] Studies from India reveal purchase of antibiotics among consumers for a shorter duration than prescribed dose.[24,43] Such findings were also noted in other countries.[36,45] Pharmacists play a key role in dispensing improper doses of antibiotics in the community. They usually dispense medicines/antibiotics as per consumers' demand, to protect their business. However, this shifts the focus from the health aspect to business and commercial ones.[34] Thus, the practice of consumers as well as of pharmacists towards antibiotics in the community leads to the irrational consumption of antibiotics.

In the Indian context, the Government of India undertook initiatives like the Red-line/box campaign which aimed at creating awareness towards antibiotics among the public. The target of this campaign was to improve awareness of consumers and to help pharmacists to encourage consumers to purchase antibiotics on current prescriptions only. The Red-line campaign highlights that antibiotics are prescription drugs and should not be taken or dispensed without a prescription.[23] However, our findings suggest most of the consumers are not aware of this initiative, rather a few consumers misapprehend it as indicative of some non-vegetarian constituent of the medicine. There is a mistaken socio-cultural-belief in the Indian population that 'green' signifies vegetarian while 'red' signifies non-vegetarian constituents of antibiotics, as is the practice in food packaging. Consumers presume that the same convention has been reflected in medicines as well. This indicates the need for more sustained efforts by government and civil society organizations in disseminating awareness about the campaign. Lack of initiative leads to low awareness in communities about antibiotics and antimicrobial resistance. it is only through continuous and sustained efforts of regulators and policy-makers, can this awareness reach consumers and communities. Our findings reiterate that there is a need to opt for some alternative method (such as changing the color of 'Red Line') to attract the attention of consumers towards misuse/overuse of antibiotics. Consumer awareness is a major intervention for reducing misuse of antibiotics and many studies have suggested consumer awareness as a measure to mitigate antimicrobial resistance.[25,26,37] Our study highlights that there is a need to educate patients about the rational use of antibiotics. A study conducted among Australian

consumers indicated education and awareness via doctors is also an effective way to bring about behavioral changes among consumers.[37] The French Government did antibiotic campaign from 2002-2007 to reduce the inappropriate use of antibiotics for multiple stakeholders including general public. This French national campaign was successful and resulted in marked reduction of antibiotics.[46] The behavioral change is a consequence of continuous Information, Education, and Communication (IEC) in the community.[47] The IEC efforts should be sustainable to have a long-lasting impact. Thus, a holistic approach to contain antibiotic misuse and antimicrobial resistance should focus on strengthening existing resources in the healthcare system, improve patient advocacy, knowledge, and awareness, and include multiple stakeholders − from dispensers (pharmacists) to prescribers (doctors or general practitioner). Thus, such measures are necessary actions in the Indian scenario.

The present study has generated information about knowledge, attitudes, and behaviors towards antibiotics in the community. The findings further articulate that effective public education initiatives should not only disseminate information but also provide practical and appropriate means to change their behavior. Consumers are critical for cautious use of antibiotics and for efforts towards containing antimicrobial resistance. This study identified that there is a need for awareness and behavioral change among consumers to optimize the use of antibiotics which can mitigate antimicrobial resistance, thus strategies towards consumer awareness should be drafted carefully.

Strength and limitations

We conducted 72 interviews of consumers across 11 districts of NCT of Delhi which is sufficient for any qualitative study. The representative number of interviews in each district was conducted until data saturation was obtained. However, the categorization of the consumers into income groups posed a limitation towards deriving any further conclusions. The number of consumers in each income group was not sufficient to conclude and comment on the findings for the income group per se. Besides, the classification of the income setting/groups in the study is completely observation-based wherein the residential setting and background of the consumers were noticed and documented carefully.

CONCLUSIONS

Our study identified the practice of inappropriate use of antibiotics among consumers through self-medication, reuse of old-prescription, and OTC purchase of antibiotics. The lack of awareness and insufficient knowledge about what antibiotics are and issues such as antimicrobial resistance or antibiotic resistance is a significant predictor of misuse of antibiotics in the community. Further, limited public healthcare access and affordability in private healthcare is also a major factor that contributes towards self-medication and the OTC purchase of antibiotics. The regular misuse of antibiotics through irrational use reinforces the need for strong enactment of strategies like awareness campaigns at the community level. The efforts to mitigate misuse of antibiotics should focus upon educating consumers continuously and sustainably for the understanding of antibiotic misuse, antimicrobial resistance, and better compliance with regulations. There is also a need to overcome highlighted gaps in the current paradigm to set realistic expectations towards the role of antibiotics in treatment practices.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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