

Prevalence of 'unused' antibiotics at homes in a central Indian district

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Abstract

Introduction: Irrational use including non-compliance with prescribed antibiotics is most crucial determinants for the emergence and spread of antimicrobial resistance. The aim of the present study was to assess the prevalence of 'unused' antibiotics among households.

Materials and Methods: A cross-sectional study was conducted among 2400 households of District Bhopal, Madhya Pradesh using a structured questionnaire. Descriptive statistics were used to describe the study results.

Results: The prevalence of unused antibiotics among surveyed households was 17.9%. Most common age group for which unused antibiotics were initially prescribed was 0-5 year of age. The major source of unused antibiotics was a public hospital (59.9%), followed by self-medication (29.6%). A total of 1,470 tablets/capsules of antibiotics were found lying unused in the surveyed homes.

Conclusion: Non-compliance with prescribed medicines and self-medication of antibiotics is a troublesome problem. More sophisticated research is needed to evaluate factors involved in the irrational use of antibiotics.

Keyword: Antibiotics, Homes, India, Unused.

Introduction

Accidental discovery of penicillin is hailed as one of the most significant milestones in the journey of medical sciences.¹ For many decades after their discovery, antibiotics were celebrated as 'miracle' life-saving drugs as they had drastically reduced the mortality due to common infectious diseases.² And today antimicrobials have become as one of the most commonly prescribed drugs worldwide.² But similar to what happened with other available resources; antibiotics were also subjected to irrational exploitation. It is estimated that at present up to 50% of all antimicrobials are prescribed irrationally.² This use, misuse, and overuse of antibiotics are considered to be the most potent reason for the rapid emergence of resistance among microbes.³ To highlight this threat, World Health Organization (WHO) selected 'combating antimicrobial resistance' as the theme for World Health Day in the year 2011. As the pipeline of newer antibiotics dries up, we are left with the same set of antibiotics but more resistant pathogens.

A host of so-called 'sub-textual' factors such as pathogen-host interactions, mutation rates, interspecies transmission (of pathogens) between human beings & animals, and cross-resistance to unrelated drugs also plays a role in the development of resistance.⁴ But till this day, the fundamental reason for the fast emergence of resistance is the irrational overuse of antibiotic either at the level of physicians, pharmacists or patients.³ To prevent the further emergence of antibiotic resistance we need to work on three-point strategy. First, we need to ensure evidence-based rational prescription of antibiotics. Secondly, we need to prevent the irrational self-medication and sale of antibiotics at the pharmacy.

Lastly, we need to ensure the compliance of patients so that each and every patient takes the full course of rationally prescribed antibiotics. Few studies have assessed the prescription and self-medication practices for antibiotics but not many studies have been conducted in India to assess whether antibiotics (prescribed/self-medicated) remain unused. Thus we conducted this study with the objective of assessing the prevalence of unused antibiotics among households of Bhopal district.

Material and Methods

Study design: This was a community-based cross-sectional household survey.

Setting: The present study was conducted in the district Bhopal, Madhya Pradesh, India.

Study Duration: The total duration of the study was fifteen months (March 2016 to May 2017).

Duration of data collection: The period of the house to house survey and data collection was 12 months (May 2016 – April 2017).

Participants: Participating unit of the study were individual households. The study was conducted in both the urban and rural areas of Bhopal district.

Exclusion criteria:

- (i) Households which were found locked at the time of the survey.
- (ii) Households which did not have any adult (> 18 years) at the time of the survey.
- (iii) Households whose member refused to participate in the survey.

Outcome: An antibiotic was defined as “unused” if it was not used for ≥ 30 days after the date of procurement (prescription/purchase).

Sample size: We collected data from 2400 households; 1200 households from urban and 1200 households from rural areas of Bhopal district.

Sampling: The study used multi-staged sampling strategy. In the first stage, twelve urban posts and twelve rural sub-centre were selected by simple random sampling. In the second stage from each selected sub-centre & urban posts, one hundred households were selected. Every community health worker (ASHA) maintains the list of all households in their catchment area. A list of all households was prepared by a health worker from which 100 households were selected by simple random sampling using the table of random numbers.

Data source: The data was collected by the means of a questionnaire designed specifically for the study. A systematic search for published literature was conducted using PubMed for designing the questionnaire.⁵⁻⁹ We also consulted WHO’s manual “How to investigate the use of medicines by consumers” for the construction of questionnaire.¹⁰ The questionnaire had two parts: first part collected data related to the sociodemographic variable of household and the second part of questionnaire collected data related to unused antibiotics. The respondent was any household member 18 years or above. If there were more than one member of the household then the person with highest educational qualification was selected for an interview. The data collectors were undergraduate nursing students. All data collectors

were given one-day training in multiple batches before starting data collection. A group of four data collectors were allotted one sub-centre/urban health post for data collection.

Data Analysis

Filled questionnaires were checked for the completeness of data before entering into the SPSS version 20.0 for analysis. Descriptive analyses were conducted to study the distribution of dependent variable among households. A P value < 0.05 was considered statistically significant.

Results

During the period of data collection a total of 2,619 houses were approached by data collectors. Of the total 147 houses were locked, 53 houses did not have an adult at the time of the survey and 19 households refused to participate in the survey. Of the total 2400 houses surveyed, we found unused antibiotics in 429 houses (prevalence rate 17.9%).

Table 1 depicts the socio-demographic profile of the households surveyed. Table 2 highlights the details related to the unused antibiotics found at home. The major source of unused antibiotics was a public hospital (59.9%), followed by self-medication/ un-prescribed (29.6%). Most of the unused antibiotics were capsule/tablets. A total of 1470 unused tablets/capsules of antibiotics were found in a total of 257 households. Table 3 details the antibiotics use and disposal practices of surveyed households.

Table 1: Socio-demographic characteristics of households included in survey (n=2400)

Socio-demographic variable	Unused antibiotics found in home		Chi-square test and p values
	Yes n=429 (%)	No n= 1971 (%)	
Number of members in family			
<4	91(21.1)	563(28.6)	P = 0.082
4-6	87 (20.3)	783(39.7)	
7-8	108 (25.2)	338(17.1)	
>8	143(33.3)	287 (14.6)	
Type of family			
Nuclear	159(37.1)	1104 (56.0)	P=0.031
Joint	270(62.9)	867 (44.0)	
Children < 1 year (infant) in family			
Yes	121(28.2)	673(34.1)	P =0.020
No	308(71.8)	1298(65.9)	
Children under five year of age in family			
Yes	310(72.3)	634(32.2)	P=0.021
No	119(27.7)	1337 (67.8)	
Person of Geriatrics age (>60 years) group in family			
Yes	269(62.7)	779(39.5)	P =0.041
No	160(37.3)	1192(60.5)	
Per-capita income			

< 2500	117 (27.3)	332(16.8)	P= 0.082
2500-5000	188 (43.8)	963(48.9)	
> 5000	124(28.9)	676(34.3)	
Family member involved in health sector			
Yes	158 (36.8)	212(10.8)	P=0.54
No	271(63.2)	1759(89.2)	
Type of involvement in health sector (n=158, n= 212)			
Physician (MBBS,BHMS, BAMS)	18(11.4)	07(3.3)	P=0.064
Nurse	26 (16.5)	44(20.8)	
Pharmacist	32(20.3)	28(13.2)	
Other	82 (51.9)	133(62.7)	
Chronic disease among household members			
Diabetes	38 (8.9)	193(9.8)	P= 0.078
Hypertension	47 (11.0)	185(9.4)	
Asthma	37 (8.6)	84(4.3)	
Allergy	43(10.0)	146(7.4)	
Other	59(13.8)	147(7.5)	

Table 2: Description of antibiotic(s) found in the surveyed households (n=429)

Study Variable	n	%
Unused antibiotic found at home		
Yes	429	17.9
No	1971	82.1
Source of antibiotic		
Public hospital	257	59.9
Private clinic + Medical store	45	10.5
Un/self-prescribed medicine	127	29.6
Spent money for antibiotics		
Yes	257	59.9
No	172	40.1
Antibiotic prescribed for which age group patient		
Infant (< 1 years)	67	15.6
children 1- < 5 years	119	27.7
children 5-12 years	93	21.7
Adolescents (12-19 years)	82	19.1
Male adults (20-60 years)	48	11.2
Female adults (20-60 years)	63	14.7
Geriatrics (> 60 years)	108	25.2
Class of antibiotic (n= 749)		
Metronidazole	118	15.8
Penicillin	18	2.4
Cephalosporin	133	17.8
Tetracyclines	37	4.9
Macrolides	59	7.9
Quinolones	74	9.9
Other antibiotics	162	21.6
Antivirals	61	8.1
Antifungal	87	11.6
Number of different types of antibiotic found in single home		
1	188	43.8
2	162	37.8
≥3	79	18.4
Type of preparation of antibiotic		
Capsule/tablet	257	59.9

Ear/Eye Drop	39	9.1
Syrup	69	16.1
Injection	12	2.8
Cream	92	21.4
Powder	48	11.2
Number of unused antibiotic capsules/tablets (n=257)		
≤3	61	23.7
4-6	116	45.1
7-9	48	18.7
≥10	32	12.5
Place where unused antibiotic are kept (n=517)		
Refrigerator	68	13.2
Cupboard	53	10.3
Shelf	132	25.5
Drawer	108	20.9
Box	104	20.1
Kitchen	52	10.1
Status of unused medicine (n=517)		
Expired	108	20.9
Not-expired	409	79.1

Table 3: Distribution of households on the basis of antibiotics use and disposal (n=429)

Study variable	n	%
Health Condition		
Sore throat /common cold	74	16.3
Fever	68	15.0
Diarrhea	72	15.9
Malaria	12	2.6
Dengue	41	9.0
Wound/injury	58	12.8
Postoperative	39	8.6
Sexually transmitted infection	51	11.2
Eye infection	23	5.1
Ear infection	16	3.5
Ever used unused antibiotics again for any condition		
Yes	179	41.7
No	250	58.3
Disposal of unused medicine		
Throw with general waste	187	43.6
Throw in drains/dustbin	168	39.2
Dump in ground pit	23	5.4
Give to those in need	51	11.9
Reason for unused antibiotics (n=454)		
Symptoms/ disease resolved earlier than expected	165	36.3
Medications were not effective	103	22.7
Forgot medication at home	32	7.0
Side effects	78	17.2
Taste of medications was unpleasant	44	9.7
Received too many medications at one time	32	7.0

Discussion

The overall prevalence of unused antibiotics among surveyed households was 17.9%. A household

survey conducted in Kerala found that 10.7 % of respondent had used antibiotics within fourteen days before the survey.⁵ Zoorob et al., in a study conducted in the USA observed that 14.2% of the respondent

reported that they have antibiotics at their home.⁶ An Iranian household survey reported that antibiotics were found in 9.8% of homes.⁷

In our study, the most common point of origin for the unused antibiotics were public hospitals. In India, most households from lower and lower-middle socioeconomic class depend heavily on the public hospitals for healthcare, as the treatment is cheap and most medicines are provided free of charge. This may well be the reason for most of the unused antibiotics originating from public hospitals, as most households covered in our study belonged to lower middle socioeconomic class (table 1). This is also reflected by the fact that no money was spent on those unused antibiotics which were procured from public hospitals (Table 1). Our findings are different from the findings of *Saradamma et al.*, who reported that 40.0% of study participants visited private healthcare facilities and most (82.4%) users of medicines (irrespective of the point of consultation) went on to procure their drugs from private medical shops.⁵ *Saradamma et al.*, also noted that even among those who consulted a government health facility, only 12.6% procured their drugs from that source.⁵ This difference can be attributed to the time gap of seventeen years between two studies, as services including the availability of medicines have improved noticeably ever since the launch of National Rural Health Mission in 2005.

Following this, the second most common source of unused antibiotics in our study was self-medication. A lot of studies have been conducted in India and the world over and collectively they all have concluded that self-medication of antibiotic is not an unusual practice. A study conducted in south India reported that as many as 71.0% of the respondent reported to have self-medicated in the past.⁸ *Saradamma et al.* reported that about 18.0% respondent used antibiotics without a prescription.⁵ The authors concluded that about four people per thousand were engaged in self-medication using antibiotics in Kerala.⁵ About 5% respondent of a study conducted in the USA reported having obtained nonprescription antibiotic in the last 12 months.⁶ Those who procure the antibiotics without prescription are not informed of either the correct dosage or the duration for which the antibiotics are needed to be taken. As a result, they might not consume all the antibiotics they bought over the counter. It is also possible they stop taking antibiotics once their symptoms subside. This, in fact, was the most common reason cited by respondents in our study for discontinuing the prescribed/procured antibiotics.

Self-medication of antibiotics is common in India despite the fact that all antibiotics have a red line printed on its back cover indicating that it has to be used only on the advice/prescription of doctors. Our finding (including that of others) confirms the fact that despite being illegal, the over-the-counter dispensation of systemic antibiotics is commonly practised by Indian

pharmacies and therefore, strict enforcement of existing laws which regulate the sale of antibiotics is the need of the hour. To reduce this, the government of India has undertaken an intense mass media campaign to increase the awareness of citizens on the safe use of antibiotics. But to be more effective, mass media campaign should be supplemented by a local two-way communication support at the hospitals which involves educating the patients about the potential risks of using nonprescription antibiotics and the inappropriateness of using antibiotic therapy for every minor ailment. In our view, a coordinated approach is needed which involves policymakers, prescribers, pharmacies and the general public using both regulatory and educational measures. Such regulations should be embedded in a prescription and sale policies related to antibiotics in order to change the perception around the use of antibiotics among the general public. We also need a strategy to reduce public misconceptions about the benefit of taking antibiotics for every minor ailment (targeting those from middle and higher socioeconomic class). The government of India can adopt the approach and strategies employed by various national governments to reduce the growing threat of antibiotics self-medication among masses.

We observed that most common age group for which the antibiotics were prescribed was 0-5 years of age, followed by geriatrics age group. As we all know, these extreme age groups have higher rates of morbidity as compared to those in the middle age group. Children under five years constitute a vulnerable group in the community, experiencing acute infectious diseases more often than adults. Those above the age of sixty also suffer although mostly from chronic illnesses but complicated by acute exacerbations demanding the use of antibiotics. We believe well this could be the reason for these findings.

In our study, most common antibiotics which were left unused were cephalosporin, followed by metronidazole, followed by antifungal medications. In the survey conducted in Kerala, the most common self-prescribed antibiotics were Pressmox, Ciplox and Ampiclox.⁴ A study conducted in the USA reported that the amoxicillin was the most commonly stored antibiotic, followed by ciprofloxacin, penicillin, and macrolides.⁵ In our study, we observed that about 41.7% of household reported that they have used the leftover antibiotics again for similar symptoms without consulting physicians. A study on unprescribed antibiotics usage in the USA also reported that about 74.0% of the respondents used leftover antibiotics.⁶ A household survey conducted in Iran reported that 9.8% of homes had unused antibiotics left-overs from doctors' prescriptions.⁷

We observed that most common health conditions for which the unused antibiotics were originally procured was the respiratory tract infection, followed by diarrhoea, followed by fever. Similar to our study,

the survey conducted in Kerala also noted that respiratory infections were the single major indication mentioned for antibiotics use.⁵ The study conducted in the USA also reported that most common reason for using unprescribed antibiotics was respiratory symptoms followed by urinary tract infections, tooth pain, stomach pain, and infection in general.⁶

The most common formulation in which antibiotics were found in the homes were tablets/capsules. Similar to our study, the survey conducted in Iran also noted that most common formulations of unused antibiotics at home were capsule/tablets.⁷ A total of 1,370 tablets/capsules were found in a total of 257 households showing wastage of precious resources. The government in partnership with local non-profit agencies can organize a campaign for preventing the abuse of antibiotics including returning the unused medicines to the hospital for either their reuse or safe disposal. This is because almost all households where unused antibiotics were found practised unsafe disposal of antibiotics.

Conflict of Interest: The authors declare that they have no conflicts of interest.

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References

- Diggins FW. The true history of the discovery of penicillin, with a refutation of the misinformation in the literature. *British journal of biomedical science*. 1999 1;56(2):83.
- Col NF, O'Connor RW. Estimating worldwide current antibiotic usage: report of task force 1. *Rev Infect Dis* 1987;9(suppl 3):232-43.
- Cars O, Nordberg P. Antibiotic resistance—The faceless threat. *International Journal of Risk & Safety in Medicine*. 2005 1;17(3,4):103-10.
- Ocan M, Obuku EA, Bwanga F, Akena D, Richard S, Ogwal-Okeng J, Obua C. Household antimicrobial self-medication: a systematic review and meta-analysis of the burden, risk factors and outcomes in developing countries. *BMC public health*. 2015 1;15(1):742.
- Saradamma RD, Higginbotham N, Nichter M. Social factors influencing the acquisition of antibiotics without prescription in Kerala State, south India. *Social science & medicine*. 2000 31;50(6):891-903.
- Zoorob R, Grigoryan L, Nash S, Trautner BW. Nonprescription antimicrobial use in a primary care population in the United States. *Antimicrobial agents and chemotherapy*. 2016 Sep 1;60(9):5527-32.
- Foroutan B, Foroutan R. Household storage of medicines and self-medication practices in south-east Islamic Republic of Iran. *Eastern Mediterranean Health Journal*. 2014 1;20(9):547.
- Balamurugan E, Ganesh K. Prevalence and Pattern of self-medication use in coastal regions of South India. *BJMP*. 2011;4(3):a428.
- Okeke IN, Lamikanra A, Edelman R. Socioeconomic and behavioral factors leading to acquired bacterial resistance to antibiotics in developing countries. *Emerg Infect Dis* 1999;5:18-27.
- World Health Organization. Antimicrobial resistance. [cited 2017 Jul 19]. Available from: <http://www.who.int/mediacentre/factsheets/fs194/en/>

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