A Survey of Antibiotics Dispensing Pattern in a Community Pharmacy of Pune City

Abstract

Background: A community pharmacist is generally involved in the activities such as dispensing of drugs and medication aids, billing, patient counseling, and provision of pharmaceutical care. Even though there is huge scope to conduct research about all these aspects in India, community pharmacy-based research is found very rarely in literature. Aim: This study aims to assess dispensing pattern and economic aspects of antibiotics in a community pharmacy on an outpatient basis. Materials and Methods: A prospective, observational study was conducted in a community pharmacy of Pune city on outpatient basis. Patient demographics and antibiotics details with cost were obtained in a log book. Various average values and defined daily doses (DDD) were determined. Chi-square test was used to determine the association between different parameters. Results: A total of 460 patients were involved in the study. Important findings were average total cost of antibiotics − INR 61.42, highest total DDD − azithromycin (107.83 g), and highest antibiotic dispensed − amoxicillin + clavulanic acid (22.61%). The parameters, prescriber and duration, age and frequency, and prescriber and frequency showed statistically significant association (P < 0.05). Conclusion: This was one of the rare studies conducted in a community pharmacy setup on outpatient basis. Further studies are needed for better understanding and documentation of the data.

Keywords: Antibiotics, community pharmacy, defined daily dose, dispensing, India

Introduction

Antibiotics can be defined as a medicine that inhibits the growth or destroy microorganisms. Although they are used in the treatment of various infections, some problems do exist with their use. They have some common side effects such as nausea, vomiting, dizziness, diarrhea, headache, itching, inflammation, and rash. Overuse of the antibiotics contributes to increase in “antibiotic resistance” − an important concern for the public health authorities at a global level. Antibiotic resistance increases the risk for human health. Treatable infectious diseases such as pneumonia and tuberculosis may become incurable because of resistance. The resistance may also increase human illness, suffering, and death; cost and length of treatment; adverse effects from use of multiple and more powerful drugs.

Over two-third of antibiotic sale in the world are accounted for outpatient use. The crude infectious disease mortality rate in India is 416.75 per 1 lac persons for that various antibiotics are used. However, there are very less research done on antibiotics usage pattern in the countries like us. Furthermore, there are extensive surveillance programs on antimicrobial resistance and antibiotic usage in developed countries, but there is lack of community-based data on antibiotic usage in developing countries.

As far as Indian scenario is considered, India was the leading consumer of antibiotics on the globe in 2010. Although schedule H and H1 have been introduced in Indian Drugs and Cosmetics Act 1945, for antibiotic usage, its impact is still unknown. In India, a community pharmacist “does” advice and dispenses antibiotics “without prescriptions.”

Community pharmacy (a retail pharmacy store) is one of the important parts of healthcare-related businesses in India. Numerous community pharmacies exist in the country, and about 8.5 million employees are directly involved in this business.
In India, a community pharmacist generally deals with activities such as dispensing of drugs/medication aids, billing, patient counseling, and rarely, provision of pharmaceutical care. Even though there is huge scope to conduct research in all these working domains, community pharmacy-based research is one of the highly unexplored areas in India. According to Basak and Sathyanarayana’s study,[13] there were only 30 research papers published in the duration from 1998 to 2008. Community pharmacists’ involvement in research was assessed by Crilly et al.[16] in UK. In the survey, >50% pharmacists feel research to be important to their practice, 88% have conducted some research in last 2 years while >65% pharmacists were interested to conduct research in future. However, such studies are very rare in India.

Considering this scenario, we aimed to access dispensing pattern and economic aspects of antibiotics in a community pharmacy on an outpatient basis. The objectives were as follows: to determine average values for the following parameters: cost of the antibiotics, dose, frequency, duration, quantity, and unit price; to determine antibiotics dispensed monthly; to determine defined daily doses (DDD) of the antibiotics; to determine statistical association between antibiotic dispensing and age and gender of the patient, prescribing physician and duration and frequency of the antibiotics.

Materials and Methods

The ethical approval from institutional review board (Thesis no. DOCP/2016-17/11) had been taken after identification of a community pharmacy from Pune city. Approval was obtained from the pharmacy owner to conduct the study. Any patient who approaches the community pharmacy for antibiotics with prescription was considered to be eligible to participate in the study, and the data were collected from them. Informed consents were obtained from the patients. A prospective, observational study was conducted for a total of 6 months. Convenience sampling was used. Data for the following parameters were collected in a logbook: age, gender, physician details (such as name, qualification, and registration number), disease symptoms, generic and brand name of the drug, route of administration, dosage form, dose (mg), frequency, duration, indication, quantity, unit price, total price and total cost of antibiotics. The data were entered in MS excel and were analyzed. An online Chi-square test calculator[17] was used to determine the association between different parameters such as age, gender, the prescriber, and duration and frequency of antibiotics. Margin of error for the sample size was determined by Raosoft calculator[18] (with 95% confidence level and 50% response distribution).

DDD for specific antibiotics was calculated using the formula: total amount of the drug dispensed divided by DDD of the antibiotic as prescribed by World Health Organization.[19,20] Average values for duration of antibiotics and nonantibiotics [Table 1] were calculated as per the following method. First, duration of antibiotics (1 day, 2 days, 3 days, and onward) was multiplied by number of responses for each day to determine the total duration.

Then, all such totals were summed to determine the total duration of all medicines. Afterward, the sum was divided by total number of patients, i.e., 460. For example, antibiotics were prescribed for 1 day to 25 patients and 2 days to 66 patients. Hence, the total values for them were 25 and 132, respectively. Then, all such number of responses was summed to get the value of 1515, and in the end, 1515 was divided by total number of patients, i.e., 460 to get the value of 3.29. Similar methodology was used in some other studies to determine the average values.[21-24]

Results

A total of 460 patients were enrolled in this study. According to Raosoft calculator, the margin of error for our sample size (i.e., 460) was 4.52% with 95% confidence level and 50% response distribution. In this study, 295 (64.13%) males and 165 (35.87%) females were involved. The age groupwise distribution of patients was as follows: 1–10 years (20, 4.34%), 11–20 years (113, 24.56%), 21–30 years (226, 49.13%),

| Duration | Number of responses | Total number of responses | Sum of total number of responses | Average value (days) |
|----------|----------------------|---------------------------|----------------------------------|----------------------|
| Antibiotics | 1 | 25 | 25 | 1515 | 3.29 |
| | 2 | 66 | 132 | | |
| | 3 | 253 | 759 | | |
| | 4 | 1 | 4 | | |
| | 5 | 96 | 480 | | |
| | 6 | 18 | 108 | | |
| | 7 | 1 | 7 | | |
| Nonantibiotics | 2 | 40 | 80 | 1601 | 3.48 |
| | 3 | 227 | 681 | | |
| | 5 | 168 | 840 | | |
31–40 years (88, 19.13%), 41–50 years (11, 2.39%), and 51–60 years (2, 0.43%).

Most of antibiotics prescribed were by oral route (n = 447, 99.13%) whereas the other routes were intravenous (n = 13, 2.83%) and eye drops (n = 4, 0.87%). All nonantibiotics were prescribed by oral route (n = 437). A total of 39 brands of antibiotics were prescribed in our study for 14 generics. The average dose of the antibiotics was 332.11 mg while nearly 90% (n = 413) antibiotics were prescribed twice daily. The average values for duration, quantity, unit price, and total cost for antibiotics and nonantibiotics are shown in Table 2. Sale of antibiotics per month was as follows: October (n = 46), November (n = 164), December (n = 76), January (n = 89), and February (n = 85).

Following 8 categories of antibiotics were dispensed in the study: penicillins, cephalosporins, macrolides, antifungals, fluoroquinolones, lincomycines, tetracyclines, and antiprotozoal. Among generic names, amoxicillin ± clavulanic acid was the highest selling antibiotic (22.61%) while metronidazole and tetracycline were the lowest (0.43%) [Table 3].

Considering the average cost of antibiotics, the highest cost was reported for cefpodoxime (INR 87.48), and the lowest cost was for metronidazole (INR 10) [Table 3].

| Table 2: Average value of antibiotics and nonantibiotics |
|-----------------|-----------------|-----------------|
| Parameter       | Antibiotics     | Nonantibiotics  |
| Average dose (mg) | 332.11          | 172.24          |
| Frequency       |                 |                 |
| OD              | 54              | 94              |
| BD              | 401             | 202             |
| TD              | 5               | 129             |
| Average duration (days) | 3.29 | 3.48 |
| Average quantity (number of tablets/units) | 6.01 | 4.95 |
| Average unit price (Rs.) | 12.77 | 12.76 |
| Average total cost (Rs.) | 61.42 | 27.15 |
| OD=Once daily, BD=Twice daily, TD=Thrice daily |

Table 3: Antibiotics dispensed in the study

| Category | Name of antibiotic | Number of patients, n (%) | Average cost (INR) |
|----------|-------------------|----------------------------|--------------------|
| Penicillin | Amoxicillin ± clavulanic acid | 104 (22.61) | 83.3 |
|          | Ampicillin        | 13 (2.83)           | 13                |
| Macrolides | Azithromycin     | 78 (16.96)          | 52.76             |
| Cephalosporins | Cefuroxime    | 68 (14.78)         | 76.23             |
|          | Cefixime         | 48 (10.43)          | 43.91             |
|          | Cefadroxil       | 37 (8.04)           | 39.24             |
|           | Cefpodoxime ± clavulanic acid | 31 (6.74) | 87.48 |
|          | Cephalexin       | 11 (2.39)           | 20                |
| Antifungal | Fluconazole      | 29 (6.30)           | 58                |
| Fluoroquinolone | Ofloxacin    | 17 (3.70)          | 47.05             |
|          | Ciprofloxacin    | 4 (0.87)            | 13                |
| Lincomycin | Clindamycin     | 16 (3.48)           | 36                |
| Tetracycline | Doxycycline    | 2 (0.43)            | 54                |
| Nitroimidazole | Metronidazole  | 2 (0.43)            | 10                |

INR=Indian National Rupees

Discussion

Various studies are available in literature about prescription pattern of antibiotics in a “hospital.” To the best of our knowledge, this is one of the rare studies in India assessing antibiotic dispensing pattern on outpatient basis in a “community pharmacy”. Furthermore, to the best of our knowledge, this is the first study of its kind from Pune city (Pune is 9th most populated city in India and 2nd in Maharashtra). [25]

Similar to Rajalingam et al. [26] and Malpani et al. [27] our study also reports higher proportion of male patients (64.13%). In Rajalingam et al.’s study, [26] highest number of patients (31%) was in late adulthood (51–65 years), but on the contrary, nearly half patients in the present study belonged to the age range 21–30 years.

Like many other studies by Jaganathan et al. [28] Malpani et al. [27] Rajalingam et al. [26] Chandy et al. [29] and Ansari [29] our study reports cephalosporins (42.39%), penicillin (25.43%), and macrolides (16.96%) to be the commonly prescribed antibiotics.

We could observe cost analysis of antibiotics in only one, i.e., Malpani’s study [27]. In that study, in 1st hospital, total antibiotics cost was INR 5844.44 and average antibiotic
Table 4: Number of defined daily dose consumed

| Name of antibiotics | ATC/DDD code | DDD | Total dose of drug (mg) | Total dose of drug (g) | Total DDD (total dose in g/DDD) |
|---------------------|--------------|-----|-------------------------|------------------------|---------------------------------|
| Amoxicillin         | J01CA04      | 1   | 47,200                  | 47.2                   | 47.2                            |
| Azithromycin        | J01FA10      | 0.3 | 32,350                  | 32.3                   | 107.83                          |
| Cefuroxime          | J01DC02      | 0.5 | 21,625                  | 21.625                 | 43.25                           |
| Cefixime            | J01DD08      | 0.4 | 12,200                  | 12.2                   | 30.50                           |
| Cefadroxil          | J01DB05      | 2   | 12,675                  | 12.675                 | 6.34                            |
| Ofloxacin           | J01MA01      | 0.4 | 2300                    | 2.3                    | 5.75                            |
| Cefpodoxime         | J01DD13      | 0.4 | 6075                    | 6.075                  | 15.19                           |
| Clindamycin         | J01FF01      | 1.2 | 2400                    | 2.4                    | 2.61                           |
| Amoxicillin*        | J01MA02      | 1   | 40                      | 0.04                   | NA                              |
| Doxycycline         | J01AA02      | 0.1 | 60                      | 0.06                   | 0.6                             |
| Metronidazole       | P01AB01      | 2   | 800                     | 0.8                    | 0.4                             |
| Fluconazole         | J02AC01      | 0.2 | 5800                    | 5.8                    | 29.18                          |

*Ophthalmic solution. NA=Not applicable, DDD=Defined daily dose, ATC=Anatomical therapeutic chemical

Table 5: $P$ value* for association between different demographic parameters

| Parameter                      | Duration | Frequency |
|--------------------------------|----------|-----------|
|                                | $\chi^2$ | Degrees of freedom | $P$* | $\chi^2$ | Degrees of freedom | $P$* |
| Age                            | 24.0904  | 30         | 0.7679 | 20.4157 | 10         | 0.02556 |
| Gender                         | 9.01848  | 6          | 0.1725 | 1.05958 | 2          | 0.5887  |
| Prescriber                     | 57.9611  | 12         | 5.181e−8 | 25.3082 | 4          | 0.00004362 |

*By using Chi-square test, $e^{−8}=10^{−8}$

cost was 45 while for the 2nd hospital, the cost were INR 6495.85 and INR 39.60, respectively. Likewise, the present study reports total antibiotic cost to be INR 28254.00 and the average cost as INR 61.42.

According to Kotwani and Holloway’s study,[10] DDDS for antibiotic dispensed in private retail sector were as follows: ciprofloxacin 7557, amoxicillin 8240, azithromycin 5404, and doxycycline 6147. DDDS for the same antibiotics as per Norris and Nguyen’s study[30] were 190475, 784593, 1505, and 4660, respectively. Similarly, total DDDS dispensed found in our study were no DDD (for ciprofloxacin), 47.2 g (for amoxicillin), 107.83 g (for azithromycin), and 0.6 g (for doxycycline).

Malpani et al.’s study[27] involved a total of 283 pediatric patients while in our study, the patients <20 years of age were nearly 29%. Furthermore, common nonantibiotics involved in Malpani’s study[27] were paracetamol (n = 157), cough syrup (n = 45), multivitamins (n = 28), and antihistaminics (n = 46) whereas the common nonantibiotic drugs in the present study were paracetamol (n = 111), cetirizine (n = 71), albuterol (n = 62), aspirin (n = 59), and ibuprofen (n = 47).

According to Imtiaz and Hafeez’s study[31] conducted in Pakistan, age and gender had shown statistically significant association with antibiotic dispensing. Whereas in our study, 3 parameters have shown statistically significant association, namely prescriber and duration of antibiotics ($P < 0.001$), age and frequency ($P = 0.02556$), and prescriber and frequency ($P < 0.001$). To the best of our knowledge, this is the first study in India assessing statistical association between age and gender of the patient; prescriber; and duration and frequency of antibiotics.

We found 2 studies conducted in Pune city about antibiotic dispensing. Deshmukh et al.’s study[32] evaluated the antibiotic dispensing pattern in a hospital pharmacy. According to the study, amoxicillin + clavulanic acid was the most commonly used antibiotic combination as in our study. Salunkhe et al.[33] determined the nonprescription use of antibiotics in 263 community pharmacies in Pune city. The study reported the proportion of antibiotics dispensed without a prescription to be high.

Like other studies by Chandy et al.,[20] Limaye et al.,[34] Sabde et al.,[35] Salunkhe et al.,[33] Shet et al.,[36] and Soumya et al.,[37] we urge mapping of prescriptions, dispensation, and self-use of antibiotics to avoid antibiotics-related problems. Efforts at city, state, and national level are recommended for the same by the government.

We faced following limitations in the study. Our study was limited to only one community pharmacy in Pune city. Hence, we could assess the prescriptions sent by the limited physicians ($n = 3$) in the same locality of the pharmacy. Furthermore, the doctors were “general physicians” (and not specialists such as dermatologist and nephrologist) means majority of the patients with only “minor illnesses” (such as cold, flu, cough, and fever) approached them. This fact further restricted our study in...
terms of diagnoses of the patients and antibiotic usage. Collecting the data from other community pharmacies in Pune region would have given better sample size and randomization in our study but we could not do the same. Since our study was limited only to one community pharmacy, we could access and analyze limited drugs and their brands. We were not able to check the rationality of antibiotics. Furthermore, we did not assess antibiotics dispensed without prescription. Since there are very few studies available in literature assessing antibiotic usage pattern of outpatients in a “community pharmacy” setup, we could get limited articles for comparison. We could not assess regulatory approval status for fixed drug combinations.

**Conclusion**

To the best of our knowledge, this is one of the rare studies conducted in India on antibiotic dispensing pattern in “a community pharmacy” and its precise assessment. The study reveals amoxicillin ± clavulanic acid to be the highest selling antibiotic; the average antibiotic cost was 61.42 rupees, average duration for antibiotic prescription was 3.29 days, and average unit price for an antibiotic was 12.77 rupees. Highest DDD was noted with azithromycin (107.83). The prescriber is statistically associated with duration and frequency of antibiotics while age of the patient showed statistical association with frequency of the antibiotics.

Mapping of prescriptions, dispensation, and self-use of antibiotics is recommended, and efforts may be taken for it at national level for better understanding of antibiotic usage at a community pharmacy. Community pharmacy-related research should be encouraged in India to enhance rational use of antibiotics and to create the awareness.

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**Conflicts of interest**

There are no conflicts of interest.

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