Received: 28 October 2020 | Revised: 13 March 2021 | Accepted: 23 March 2021

DOI: 10.1002/emp2.12432

JACEP OPEN
JOURNAL OF THE AMERICAN COLLEGE OF EMERGENCY PHYSICIANS OPEN
A GLOBAL JOURNAL OF EMERGENCY MEDICINE
Open Access
WILEY

ORIGINAL RESEARCH

Infectious Disease

Self-prescribing of antibiotics by patients seeking care in Indian emergency departments

Janice Blanchard MD, PhD[1] | **Madhumathi Solaipandian MBBS, MEM**[2] | **Elina Bevin John MBBS, MEM**[3] | **Moin Pandith MBBS, MEM**[4] | **Binu Jeo MBBS, MEM**[5] | **Sherin Saji MBBS, MEM**[6] | **Anil Kumar MBBS, MEM**[7] | **Larissa May MD, MSPH**[8] | **Kevin Davey MD**[1] | **Katherine Douglass MD, MPH**[1] | **Jeffrey Smith MD, MPH**[1]

[1] Department of Emergency Medicine, George Washington University, Washington, District of Columbia, USA

[2] Meenakshi Mission Hospital, Madurai, India

[3] BR Life SUT Hospital Pattom, Trivandrum, Kerala, India

[4] Max Super Specialty Hospital, Patparganj, Max, Delhi, India

[5] Baby Memorial Hospital, Calicut, Kerala, India

[6] MGM Muthood Medical Centre Hospital, Kozhencherry, Pathanamthitta, India

[7] Max Superspecialty Hospital, Delhi, India

[8] Department of Emergency Medicine, University of California Davis, Sacramento, California, USA

Correspondence
Janice Blanchard, MD, PhD, George Washington Department of Emergency Medicine, 2120 L Street NW, Washington, DC 20037, USA.
Email: jblanchard@mfa.gwu.edu

Meeting: This work was presented at the American College of Emergency Physicians Scientific Assembly, October 2019, Denver, Colorado.

Funding and support: By *JACEP Open* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). The authors have stated that no such relationships exist.

Abstract

Study objective: Antibiotic resistance is a global health threat. India has one of the highest rates of antibiotic use in the world. The objective of this study was to evaluate the prevalence of self-prescribed antibiotic use of patients presenting with febrile and infectious disease-related complaints to Indian emergency departments.

Methods: This was a prospective observational study conducted at 6 Indian emergency departments (EDs) between January 1, 2019 and December 31, 2019. Adult patients who presented with a chief complaint of febrile illness or infectious disease complaints were included. Our principal outcomes of interest were self-prescribed use of antibiotics within the prior 6 months or for the presenting complaint. We queried respondents about source of antibiotics as well as about demographic characteristics that influenced use.

Results: A total of 1421 patients were enrolled. Sixty percent (n = 856) of respondents reported using antibiotics in the prior 6 months or for their current complaint. Those who reported self-prescribing antibiotics either in the past or currently had at least some college education ($P < 0.001$), tended to use the pharmacy ($P < 0.001$) or the ED ($P = 0.001$) for their care when sick, and were more likely to have some comorbid conditions ($P = 0.014$) as compared to the group that did not self-prescribe antibiotics. The

Supervising Editor: Grant S. Lipman, MD.

most common reason respondents reported self-prescribing antibiotics was because they did not want to wait to see their doctor (n = 278, 33%). Thirty-five percent of patients who were self-prescribed antibiotics before presentation did not receive and were not prescribed antibiotics in the ED, at discharge, or both.

Conclusions: Self-prescribing of antibiotics occurs commonly in India. This use increases the risk for resistance due to inappropriate or unnecessary use. Promotion of antibiotic stewardship is needed to curtail such use.

KEYWORDS
antibiotics, emergency department, India, self-prescribing, stewardship

1 | INTRODUCTION

1.1 | Background

Antibiotic resistance has become a global health threat. Over 2.8 million illnesses and 35,000 deaths are estimated to occur in the United States because of antibiotic resistance each year.[1–3] Misuse of antibiotics, both for conditions in which such medications are not needed and incorrect dosing regimens, have contributed to this problem.[4,5] In the United States, for example, an average of 22 doses of antibiotics are prescribed per person annually.[6] The Centers for Disease Control and Prevention estimates that antibiotics are prescribed inappropriately in as many as 50% of cases.[1,2] Worldwide, antibiotics are even more readily available.[7] A systematic review of antibiotic use in low to middle income countries estimated an ≈39% prevalence of use, most commonly for febrile, respiratory, or gastrointestinal illnesses.[8] Approximately 62% of community pharmacies across the globe supply antibiotics without a prescription.[9] In many cases, these antibiotics are prescribed with little direction or oversight by pharmacy staff.[10]

India has one of the highest rates of antibiotic use in the world.[6] Use of antibiotics in India increased by over 100% between 2000 and 2015.[11] A combination of poor access to clinicians and ease of attainability from pharmacists has contributed to the use of over-the-counter antibiotics in the country.[12] In addition to ready access to approved antibiotics, approximately a third of antibiotic sales in India are of non-approved drug formulations.[13]

1.2 | Importance

Despite its widespread use in India, most studies have focused on antibiotic use in specific regions of the country or in the community setting.[14–19] To date, to our knowledge, there have been no multistate studies in India evaluating the prevalence of self-prescribed antibiotics in a population of patients presenting to the emergency department for an acute complaint.

2 | METHODS

2.1 | Study design and setting

Our study was a prospective observational study conducted at 6 EDs in 3 states in India (Kerala, Tamil Nadu, and Delhi). Using a convenience sample, respondents were enrolled over a 1-year period from January 1, 2019 to December 31, 2019.

2.2 | Selection of participants

We included patients aged 18 years and over with a chief complaint identified on the nursing triage record of any of the following: fever/febrile illness (including concern for dengue, chikungunya, malaria), dysuria, upper respiratory symptoms, gastrointestinal symptoms, sore throat, or symptoms related to other infectious diseases (chicken pox, measles, or influenza). Patients transferred from other medical facilities were excluded from our study.

2.3 | Measurements

Respondents were administered a survey, completed with the assistance of trained physician researchers in their language of choice (English, Hindi, Malayalam, or Tamil). Physician researchers were trained in person or by Skype on criteria and data collection methods by the senior author (JB). We first piloted the survey with 3 respondents at 3 different sites for comprehension and clarity. Patients were enrolled across varying shifts, days, and months to include a diverse spectrum of triage complaints. Respondents were first queried about whether they had self-prescribed antibiotics in the past 6 months. Respondents then were asked if they had taken an antibiotic for their current complaint. Those who either had taken antibiotics in the past 6 months or for their current complaint were asked about reasons they used the drug, where they got the medication, the source of information about which antibiotic to choose, and out-of-pocket costs. In addition, those who had self-prescribed antibiotics for their current complaint were

asked about the name of the antibiotic used (either by showing the bottle to the research assistant (RA) or by self-report), the number of doses taken, and the duration of use. We recorded information about the respondent's visit, specifically whether they received an antibiotic in the ED or at discharge, their final diagnosis, and disposition. Respondents were queried about their sociodemographic background, insurance coverage, usual source of care, and primary care access.

2.3.1 | Goals of investigation

The objective of this study was to evaluate the prevalence of self-prescribed antibiotic use of patients presenting with febrile and infectious disease related complaints to a multisite sample of Indian EDs.

The Bottom Line

The health threat of antibiotic resistance is contributed to by unnecessary antibiotic use. This prospective observational study of 6 emergency departments in India found 653 (46%) of studied patients with infectious disease complaints self-prescribed antibiotics, with 35% of them not receiving further antibiotics, highlighting the potential for improved antibiotic stewardship.

TABLE 1 Demographics of sample by patients who took antibiotics for current complaint

		Self-prescribed antibiotic use in the past 6 months			Self-prescribed antibiotic use for current complaint			Any self-prescribed antibiotic use (past 6 months or for current complaint)		
N = 1421	Total Samplen = 150n (%)	Yesn = 697	Non = 724	*P* value	Yesn = 653	Non = 768	*P* value	Yesn = 856	Non = 565	*P* value
Mean age (SD)	43.9 (17.0)	43.8 (16.9)	44.0 (17.2)	0.840	43.1 (16.7)	44.6 17.3)	0.115	43.5 (16.6)	44.5 (17.6)	0.288
Sex										
Male	782 (55.0)	391 (56.1)	391 (54.0)	0.428	382 (58.5)	400 (52.1)	0.015	487 (56.9)	295 (52.2)	0.083
Education										
High school graduate or less	461 (32.4)	194 (27.8)	267 (36.9)	<0.001	168 (25.7)	293 (38.2)	<0.001	245 (28.6)	216 (38.2)	<0.001
Some college or more	933 (65.7)	491 (70.4)	442 (61.1)	<0.001	482 (73.8)	451 (58.7)	<0.001	599 (70.0)	334 (59.1)	<0.001
Unknown/no answer	19 (1.3)	10 (1.4)	9 (1.2)	0.753	2 (0.3)	17 (2.2)	0.002	10 (1.1)	9 (1.6)	0.496
Regular doctor/health professional										
Yes	739 (52.0)	362 (51.9)	377 (52.1)	0.959	342 (52.4)	397 (51.7)	0.798	453 (49.6)	286 (50.6)	0.396
Insurance										
Insurance covers prescriptions	585 (41.2)	284 (40.8)	301 (41.6)	0.751	267 (40.9)	318 (41.4)	0.843	359 (41.9)	497 (58.1)	0.468
Insurance but does not cover prescriptions	638 (44.9)	306 (43.9)	332 (45.9)	0.460	287 (44.0)	351 (45.7)	0.509	368 (43.0)	270 (47.8)	0.075
No insurance	171 (12.0)	95 (13.6)	76 (10.5)	0.070	96 (14.7)	75 (9.8)	0.004	117 (13.7)	54 (9.6)	0.020
Unknown	27 (1.9)	12 (1.7)	15 (2.1)	0.629	3 (0.5)	24 (3.1)	<0.001	12 (1.4)	15 (2.7)	0.090
Source of care when sick										
Doctor's office	436 (30.7)	190 (27.3)	246 (34.0)	0.006	184 (28.2)	252 (32.8)	0.059	240 (28.0)	196 (34.7)	0.396
Pharmacy	227 (16.0)	120 (17.2)	107 (14.8)	0.210	127 (19.4)	100 (13.0)	<0.001	165 (19.3)	62 (11.0)	<0.001
ED	211 (14.9)	124 (17.8)	87 (12.0)	0.002	108 (16.5)	103 (13.4)	0.099	148 (17.3)	63 (11.2)	0.001
OPD (urgent care)	321 (22.6)	156 (22.4)	165 (22.8)	0.854	146 (22.4)	175 (22.8)	0.848	178 (20.8)	143 (25.3)	0.046
Ayurvedic	60 (4.2)	32 (4.6)	28 (3.9)	0.498	29 (4.4)	31 (4.0)	0.706	40 (4.7)	20 (3.5)	0.299
No one	146 (10.3)	67 (9.6)	16 (16.2)	0.667	51 (7.8)	95 (12.3)	0.027	76 (8.9)	70 (12.4)	0.033
Unknown	19 (1.4)	10 (1.4)	9 (1.2)	0.415	8 (1.2)	12 (1.6)	0.591	7 (0.8)	5 (0.9)	0.892
Any chronic disease	816 (57.4)	424 (60.8)	392 (54.1)	0.011	407 (62.3)	409 (53.3)	<0.001	514 (60.0)	302 (53..4)	0.014
State										
Delhi	522 (36.7)	339 (48.6)	183 (25.3)	<0.001	321 (49.2)	201 (26.2)	<0.001	417 (48.7)	105 (18.6)	<0.001
Kerala	599 (42.2)	227 (32.5)	372 (51.4)	<0.001	204 (31.2)	395 (51.4)	<0.001	246 (28.7)	353 (62.5)	<0.001
Tamil Nadu	300 (21.1)	131 (18.8)	169 (23.3)	0.06	128 (19.6)	172 (22.4)	0.199	193 (22.5)	107 (18.9)	0.103

OPD, outpatient department.

TABLE 2 Multivariate analysis, self-prescribed antibiotic use, (OR, 95% CI)[a]

	Self-prescribed antibiotic use in the past 6 months	Self-prescribed antibiotic use for current complaint	Any self-prescribed antibiotic use(past 6 months or for current complaint)
Mean age	1.00 (0.99–1.01)	0.99 (0.99–1.00)	1.00 (0.99–1.01)
Sex			
Female	1.00	1.00	1.00
Male	1.06 (0.85–1.32)	1.23 (0.98–1.55)	1.14 (0.90–1.44)
Education			
Less than college degree	1.00	1.00	1.00
College degree or more	1.66 (1.26–2.19)	2.07 (1.56–2.74)	1.98 (1.47–2.67)
Regular doctor/health professional			
No	1.00	1.00	1.00
Yes	0.93 (0.74–1.17)	0.87 (0.68–1.10)	0.93 (0.72–1.20)
Insurance			
Insurance but does not cover prescriptions	1.00	1.00	1.00
Insurance covers prescriptions	1.18 (0.91–1.53)	1.22 (0.94–1.59)	1.38 (1.04–1.81)
No insurance	1.24 (0.86–1.79)	1.43 (0.98–2.07)	1.60 (1.06–2.42)
Source of care when sick			
Doctor's office	1.00	1.00	1.00
ED/OPD	1.46 (1.12–1.92)	1.30 (0.99–1.72)	1.45 (1.09–1.94)
Pharmacy	1.19 (0.84–1.68)	1.47 (1.02–2.10)	1.42 (0.96–2.09)
No one	1.43 (0.95–2.16)	0.90 (0.58–1.37)	1.27 (0.83–1.95)
Ayurvedic/other	1.88 (1.10–3.20)	1.87 (1.09–3.21)	2.26 (1.27–4.03)
Chronic disease			
None	1.00	1.00	1.00
Any chronic disease	1.28 (0.99–1.66)	1.64 (1.25–2.13)	1.41 (1.06–1.87)
State			
Delhi	1.00	1.00	1.00
Kerala	0.14 (0.09–0.23)	0.15 (0.09–0.25)	0.06 (0.04–0.11)
Tamil Nadu	0.16 (0.09–0.32)	0.19 (0.10–0.38)	0.14 (0.07–0.28)

[a]Controlled for site of enrollment.
ED, emergency department; OPD, outpatient department.

2.4 | Outcomes

Our principal outcome of interest was self-prescribed use of antibiotics for either the current complaint or in the prior 6 months. We also examined each of these outcomes separately: (1) self-prescribed use of antibiotics in the prior 6 months and (2) self-prescribed use of antibiotics for the current presenting ED complaint.

2.5 | Analysis

We conducted univariate analysis of our sample using Student *t* test of means. Next we conducted logistic multivariate analysis examining the relationship between our outcomes of interest and demographic characteristics controlling for age, sex, education level, insurance status (prescription coverage, non-prescription insurance coverage, or no insurance), presence of a primary medical doctor, usual source of care accessed when sick (doctor's office, ED, outpatient department/urgent care, ayurvedic practitioner, pharmacy, other, or no care), any associated comorbid conditions (asthma, diabetes, congestive heart failure, cardiac disease, hypertension, cerebral vascular disease, renal disease, cancer, or other chronic diseases), and site of enrollment. All analysis was done using STATA version 13.

The study was approved by the George Washington University Human Subjects Review Committee with permission from the sites.

3 | RESULTS

3.1 | Characteristics of study subjects

During our study period, we enrolled a total of 1421 patients. Sixty percent (n = 856) of respondents reported having used antibiotics either in the prior 6 months or for their current complaint. Of these, 697

self-prescribed antibiotics in the past 6 months and 653 self-prescribed an antibiotic for the current complaint. Those who were reported self-prescribing antibiotics either in the past or currently were more likely to have at least some college education, use the pharmacy or the ED for their care when sick, and have some comorbid conditions as compared to the group who did not use antibiotics. Delhi had the highest prevalence of antibiotic use and Kerala had the lowest (Table 1).

3.2 | Main results

In multivariate analysis, respondents with at least some college education were more likely to have self-prescribed antibiotics either in the past 6 months or for their current complaint as compared to those with less education. In addition, persons whose insurance covered their prescriptions or who had no insurance had higher odds of self-prescribing antibiotics as compared to those who did not have any insurance coverage. Those who used the ED or outpatient department or aryuvedic or other care self-prescribed antibiotics more as compared to those who used a doctor's office when sick. Having a comorbid medical condition also was associated with higher odds of self-prescribing antibiotics as compared to not having such conditions (Table 2).

The most common reasons respondents reported self-prescribing antibiotics either for their current complaint or in the prior 6 months was because they did not want to wait to see their doctor, because they were too busy to see their doctor, based on the advice of relatives or friends, or because of cost restrictions (Table 3). Respondents most often got their doses from a pharmacy, but other frequent sources were from leftover prescriptions from prior use or from a family member or friend. The pharmacist was also the most common source of information about which antibiotic to take. The average reported cost of the antibiotic was equivalent to about $3.60 US dollars.

Table 4 shows the diagnosis, disposition, and receipt of antibiotics in the ED or at discharge for respondents. Of respondents who used antibiotics for their current presenting complaint, the most common final diagnoses were upper respiratory illness, gastroenteritis, and urinary tract infection. The majority of patients in our sample were discharged. The proportion of patients who were discharged was lower in the group who took antibiotics compared to those who did not take antibiotics. About two thirds of patients who self-prescribed antibiotics before presentation were given or prescribed antibiotics in the ED, at discharge, or both. In cases in which the antibiotic was known, penicillins were the most commonly self-prescribed class followed by macrolides, quinolones, and cephalosporins, although in many cases, patients did not know the name of the antibiotic that they had used (Table 5). A large proportion of patients reported taking 3 or more doses of antibiotics. Almost half of respondents reported taking the antibiotic for 3 days or more.

3.3 | Limitations

There are several limitations to our study. We do not know how many patients were discharged on the same antibiotic that they were taking before presentation to the ED or whether patients had self-prescribed an antibiotic that was later considered appropriate for their complaint. Some patients may have been appropriately self-prescribed antibiotics and then subsequently were not discharged on them. We also do not know if participants who had previously taken antibiotics for their current complaint presented because of failure of antibiotics or for confirmation of diagnosis, which may have underestimated the number of people who actually needed antibiotics for their diagnosis. We do not have information about those who refused to complete the survey or about whether our sample reflected the larger population of ED patients. Because it was a convenience sample, we may have had some response bias. There also may have been recall bias regarding prior antibiotic use. Our study was done at 6 private hospitals in 3 states and therefore may not be generalizable to other parts of India or public hospitals. Respondents in our sample may have had differences in sociodemographic characteristics associated with the use of private hospitals that may have influenced rates of antibiotic use. Because we focused on a subset of complaints that may have increased the likelihood of antibiotic use such as febrile illness and infectious diseases, our prevalence rate may have been higher. Finally, our study was completed in the period before awareness of the COVID-19 pandemic. It is unknown how rates of antibiotic use in India may have been subsequently affected since our study period. Early recommendations in the country about the use of hydroxychloroquine and azithromycin for

TABLE 3 Self-prescribed antibiotic use, source of antibiotic, source of information, and average reported cost (n = 856)

	n	%
Reason used[a]		
Did not want to wait to see doctor	278	32.5
Too busy to see doctor	254	29.7
Relatives or friends advised	244	28.5
Costs too much	215	23.2
Not happy with doctor advice	99	11.6
Did not trust doctor	94	11.0
Source of antibiotic		
Pharmacy	329	38.4
Left over	180	21.0
Family/friend	174	20.3
Ayurvedic	98	11.4
Other/unknown	75	8.8
Source of knowledge of which antibiotic		
Pharmacist	328	38.3
Friend	215	25.1
Copied name from prior prescription	158	18.5
Internet search	108	12.6
Other/unknown	22	2.6
Mean cost (rupees)	261.9	

[a]Could select >1 answer.

TABLE 4 Final diagnosis and disposition by use of antibiotics at home for current complaint

Final provider diagnosis	Took antibiotics at home for current complaintn =653 n (%)	Did not take antibiotic at home for current complaintn =768 n (%)	*P* value
URI (n = 230)	97 (14.9)	133 (17.3)	0.209
Gastroenteritis (n = 218)	108 (16.5)	110 (13.9)	0.248
UTI (n = 192)	87 (13.3)	105 (13.2)	0.848
Pharyngitis/tonsillitis (n = 143)	71 (10.6)	78 (9.6)	0.660
Viral illness (n = 126)	51(7.8)	75 (9.8)	0.260
Pneumonia (n = 116)	56 (8.6)	60 (7.8)	0.601
Dengue (n = 103)	56 (8.6)	47 (6.1)	0.115
Sepsis (n = 57)	30 (4.6)	27 (3.5)	0.192
Chickenpox (n = 31)	12 (1.8)	19 (2.5)	0.414
Influenza (n = 28)	12 (1.8)	16 (2.1)	0.740
Cellulitis/abscess (n = 26)	11 (1.7)	15 (2.0)	0.541
Chikungunya (n = 21)	13 (2.0)	8 (1.0)	0.140
Meningitis (n = 18)	11 (1.7)	7 (0.9)	0.194
Malaria (n = 11)	6 (0.9)	5 (0.7)	0.566
Measles (n = 9)	1 (0.2)	8 (1.0)	0.058
Other (n = 82)	26 (4.0)	56 (7.3)	0.035
Disposition			
Home (n = 791)	334 (51.1)	457 (59.5)	0.002
Inpatient floor (n = 396)	191 (29.2)	205 (26.7)	0.284
Intensive care (n = 164)	79 (12.1)	85 (11.1)	0.545
Other (n = 70)	49 (7.5)	21 (2.7)	<0.001
Received antibiotics in ED or at discharge (n = 856)	421 (64.5)	435 (56.6)	0.003

ED, emergency department; URI, upper respiratory infection; UTI, urinary tract infection.

prophylaxis in physicians may have later affected use of antibiotics in the community.[20–22]

4 | DISCUSSION

Our study showed a relatively high percentage of antibiotic use in patients presenting to Indian EDs. Although there was some regional variation, almost half or respondents reported self-prescribing an antibiotic either in the prior 6 months or for the current complaint. In the state with the lowest rate of use in our sample, Kerala, still over a third of ED patients reported either using antibiotics in the past or for their current complaint. Prior studies evaluating the use of prescription antibiotics are limited. A meta-analysis of antibiotic use in World Health Organization Southeast Asian countries showed rates of self-prescribed antibiotic use ranging from 33%–39% in the general public and rates as high as 85% among physicians.[17] A study in Kerala India found that 18% of customers presenting to the pharmacy setting requested an antibiotic without a prescription.[19] Another study in Pondicherry demonstrated that 12% of residents surveyed reported self-medicating with over-the-counter drugs, with 10% of this group taking antibiotics.[18] Our results are slightly higher than those previously reported in other Indian samples. However, prior studies were restricted to single regions and were not focused on patients presenting with acute complaints. It is likely that patients who have a high suspicion of infectious illness, such as those sampled for our study, may be more likely to use antibiotics compared to the general public. Our numbers are also higher than those reported in other Western studies. In 1 review of prior research examining self-prescribed antibiotic use in the United States, prevalence rates ranged from 1%–66%, with the highest rates reported among Latino immigrants with poor access to care.[23] In a study of an ED population in the United States, 17% of respondents had reported taking leftover medications previously prescribed by their physicians.[24] Our higher numbers compared to US-based studies may be because of the more ready access to antibiotics in India.

Antibiotic use has a number of consequences for which the public may not be aware when choosing to self-prescribe. Antibiotics, whether with or without a prescription, increase the risk of adverse drug events. In the United States, antibiotics account for a

TABLE 5 Antibiotic class, number of doses, and number of days taken of patients who took antibiotics used for current complaint (n = 653)

	n	%
Antibiotic class		
Macrolide	123	18.8
Penicillin	116	17.8
Fluoroquinolone	89	13.6
Cephalosporin	85	13.2
Nitrofurantoin	45	6.9
Aminoglycoside	26	3.7
Nitromidazole/metronidazole	20	3.1
Sulfonamide	14	2.1
Tetracycline	11	1.7
Carbapenem	10	1.5
Other/do not know	117	17.9
Number of doses of antibiotics taken		
1	95	14.5
2	219	33.5
3 or more	276	42.3
Unknown	61	9.3
Number of days antibiotics taken		
1 day	73	11.2
2 days	180	27.6
3 days	233	35.7
4 days	77	11.8
5 or more days	60	9.2
Unknown	30	4.6

significant proportion of visits for medication-related ED visits, particularly in children.[12] Another notable consequence of antibiotic misuse is drug resistance. Most of the respondents in our sample had taken multiple days and multiple doses of antibiotics. However, only 57% of individuals who had self-prescribed an antibiotic received one during their ED visit or at discharge. This may indicate that respondents may have taken antibiotics only for a limited time period. Self-prescribing of antibiotics is associated with incomplete treatment courses for illnesses increasing the concern for the development of drug resistence.[25,26] The global burden of antimicrobial resistance is increasing, with such misuse of antibiotics contributing to an estimated 700,000 deaths from multidrug resistance pathogens.[27,28] In India, for example, there is a 17% mortality rate from gram negative multidrug resistant pathogens.[29]

In our sample penicillins, macrolides, fluoroquinolones, and cephalosporins were reported as being self-prescribed most often. The most common final diagnoses were urinary tract infections, gastroenteritis, and upper respiratory infection. This is consistent with prior data. Worldwide, urinary tract infections and upper respiratory infections are the most common complaints for which non-prescription antibiotics are supplied, with fluoroquinolones and penicillins most frequently used.[10]

Reducing inappropriate use of antibiotics is one of the most important interventions to decrease the prevalence of drug-resistant pathogens.[30] India has issued practice guidelines to help direct physicians about the proper prescribing of antibiotics in response to rising rates of resistance to carbapenems and antibiotics.[31] Although such guidelines may have an impact on in-hospital overuse, additional approaches also are needed to curb use in the community. In 2013, India instituted regulations requiring that pharmacies dispense antibiotics only with a valid prescription.[32] However, enforcement of such laws has been challenging.[32] Pharmacies can vary in terms of staffing, training, and the role they play as a medical physicians in many communities.[33] This may be further complicated by patient expectations regarding the receipt of antibiotics even when not clinically indicated.[34] Our study suggests that in India, there is a need for educational programs emphasizing on the risks associated with indiscriminate antibiotic use. Such education must be multifaceted-targeting consumers, clinicians, and pharmacists to be most effective.[35,36] Antibiotic stewardship programs (ASP) in both hospitals and community pharmacies are important approaches that may help achieve this goal.[36,37] Improving consumer health literacy about antibiotics is an important component to curtail misuse.[38] Our study demonstrates that the ED offers a potential opportunity to reach patients for such efforts. Educational toolkits, videos, and information sheets are all potential mechanisms that can be used for patients in the ED appropriately and have been used successfully as part of outpatient ASPs.[39] Limited evidence has shown some success rates in such strategies in improving knowledge, attitudes, and beliefs about antibiotics among consumers.[40]

In summary, self-prescribing of antibiotics is common in cases of acute illness in India. Patients who self-prescribe antibiotics are often not treated with antibiotics in the ED, increasing the risk of antibiotic resistance. More education is needed about the safe use of antibiotics, especially in areas where antibiotics are commonly available without a prescription. Future research is needed to evaluate the role that the ED can have in promoting antibiotic stewardship programs that target the consumer as well as interventions that are most effective in this setting, particularly in India.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

JB conceived the study and analyzed the data. JB, LM, KD, JS, and KD developed the survey instrument. MS, EJ, MP, BJ, SS, and AK recruited participants and managed and collected data. JB drafted the manuscript, and all authors contributed substantially to its revision. JB takes responsibility for the paper as a whole.

REFERENCES

1. Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States. Vol 20202013.
2. Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs Vol 20202017.
3. Centers for Disease Control and Prevention. Antibiotic Resistance Threats In the United States. Vol 20202019.
4. Awad AI, Aboud EA. Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. *PLoS One*. 2015;10: e0117910.
5. Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. *P T*. 2015;40:277-283.
6. Van Boeckel TP, Gandra S, Ashok A, et al. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. *Lancet Infect Dis*. 2014;14:742-750.
7. Klein EY, Milkowska-Shibata M, Tseng KK, et al. Assessment of WHO antibiotic consumption and access targets in 76 countries, 2000–15: an analysis of pharmaceutical sales data. *Lancet Infect Dis*. 2021;21:107-115.
8. Ocan M, Obuku EA, Bwanga F, et al. Household antimicrobial self-medication: a systematic review and meta-analysis of the burden, risk factors and outcomes in developing countries. *BMC Public Health*. 2015;15:742.
9. Morgan DJ, Okeke IN, Laxminarayan R, Perencevich EN, Weisenberg S. Non-prescription antimicrobial use worldwide: a systematic review. *Lancet Infect Dis*. 2011;11:692-701.
10. Auta A, Hadi MA, Oga E, et al. Global access to antibiotics without prescription in community pharmacies: a systematic review and meta-analysis. *J Infect*. 2019;78:8-18.
11. Klein EY, Van Boeckel TP, Martinez EM, et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proc Natl Acad Sci U S A*. 2018;115:E3463-E3470.
12. Shehab N, Lovegrove MC, Geller AI, Rose KO, Weidle NJ, Budnitz DS. US emergency department visits for outpatient adverse drug events, 2013–2014. *JAMA*. 2016;316:2115-2125.
13. McGettigan P, Roderick P, Kadam A, Pollock A. Threats to global antimicrobial resistance control: centrally approved and unapproved antibiotic formulations sold in India. *Br J Clin Pharmacol*. 2019;85:59-70.
14. Parkunan T, Ashutosh M, Sukumar B, et al. Antibiotic resistance: a cross-sectional study on knowledge, attitude, and practices among veterinarians of Haryana state in India. *Vet World*. 2019;12:258-265.
15. Swamy A, Sood R, Kapil A, et al. Antibiotic stewardship initiative in a Medicine unit of a tertiary care teaching hospital in India: a pilot study. *Indian J Med Res*. 2019;150:175-185.
16. Shamsudeen SM, Priya RS, Sujatha G, Muruganandhan J, Manikandan K. Self-medication with antibiotics: a knowledge, attitude, and practice appraisal of 610 dental patients in Chennai, India, from 2016 to 2017. *J Educ Health Promot*. 2018;7:66.
17. Nepal G, Bhatta S. Self-medication with antibiotics in WHO southeast Asian region: a systematic review. *Cureus*. 2018;10: e2428.
18. Selvaraj K, Kumar SG, Ramalingam A. Prevalence of self-medication practices and its associated factors in Urban Puducherry, India. *Perspect Clin Res*. 2014;5:32-36.
19. Saradamma RD, Higginbotham N, Nichter M. Social factors influencing the acquisition of antibiotics without prescription in Kerala State, south India. *Soc Sci Med*. 2000;50:891-903.
20. Panigrahi SK, Majumdar S, Pal A, Parija PP, Bharath DU. Covid-19 chemoprophylaxis: ethics of prevention based on anecdotal evidence. *Indian J Med Ethics*. 2020;-:1-6.
21. Rathi S, Ish P, Kalantri A, Kalantri S. Hydroxychloroquine prophylaxis for COVID-19 contacts in India. *Lancet Infect Dis*. 2020;20: 1118-1119.
22. Tilangi P, Desai D, Khan A, Soneja M. Hydroxychloroquine prophylaxis for high-risk COVID-19 contacts in India: a prudent approach. *Lancet Infect Dis*. 2020;20:1119-1120.
23. Grigoryan L, Germanos G, Zoorob R, et al. Use of Antibiotics without a prescription in the U.S. population: a scoping review. *Ann Intern Med*. 2019;171:257-263.
24. Richman PB, Garra G, Eskin B, Nashed AH, Cody R. Oral antibiotic use without consulting a physician: a survey of ED patients. *Am J Emerg Med*. 2001;19:57-60.
25. Awad A, Eltayeb I, Matowe L, Thalib L. Self-medication with antibiotics and antimalarials in the community of Khartoum State, Sudan. *J Pharm Pharm Sci*. 2005;8:326-331.
26. Apisarnthanarak A, Tunpornchai J, Tanawitt K, Mundy LM. Nonjudicious dispensing of antibiotics by drug stores in Pratumthani, Thailand. *Infect Control Hosp Epidemiol*. 2008;29:572-575.
27. Langford BJ, Schwartz KL. Bringing home unwelcome souvenirs: travel and drug-resistant bacteria. *Can Commun Dis Rep*. 2018;44:277-282.
28. Langford BJ, Morris AM. Is it time to stop counselling patients to "finish the course of antibiotics"? *Can Pharm J*. 2017;150:349-350.
29. Gandra S, Tseng KK, Arora A, et al. The mortality burden of multidrug-resistant pathogens in India: a retrospective, observational study. *Clin Infect Dis*. 2019;69:563-570.
30. Sanchez GV, Fleming-Dutra KE, Roberts RM, Hicks LA. Core elements of outpatient antibiotic stewardship. *MMWR Recomm Rep*. 2016;65:1-12.
31. India tackles superbug menace with antibiotic guidelines. *Scientific American*. Vol 2020. https://www.scientificamerican.com/article/india-tackles-superbug-menace-with-new-antibiotic-guidelines/ 2017.
32. Hazra A. Schedule H1: hope or hype? *Indian J Pharmacol*. 2014;46:361-362.
33. Nye C, Watson T, Kubasiewicz L, Raw Z, Burden F. No prescription, no problem! A mixed-methods study of antimicrobial stewardship relating to working equines in drug retail outlets of Northern India. *Antibiotics (Basel)*. 2020:9.
34. Wang X, Xuan Z, Storella TH, Zhou X. Determinants of non-prescription antibiotic dispensing in Chinese community pharmacies from socio-ecological and health system perspectives. *Soc Sci Med*. 2020;256:113035.
35. Atif M, Asghar S, Mushtaq I, Malik I. Community pharmacists as antibiotic stewards: a qualitative study exploring the current status of Antibiotic Stewardship Program in Bahawalpur, Pakistan. *J Infect Public Health*. 2020;13:118-124.
36. Barlam TF, Childs E, Zieminski SA, et al. Perspectives of physician and pharmacist stewards on successful antibiotic stewardship program implementation: a qualitative study. *Open Forum Infect Dis*. 2020;7:ofaa229.
37. Tonna AP, Weidmann AE, Sneddon J, Stewart D. Views and experiences of community pharmacy team members on antimicrobial stewardship activities in Scotland: a qualitative study. *Int J Clin Pharm*. 2020;42:1261-1269.
38. Hermsen ED, MacGeorge EL, Andresen ML, Myers LM, Lillis CJ, Rosof BM. Decreasing the peril of antimicrobial resistance through enhanced health literacy in outpatient settings: an underrecognized approach to advance antimicrobial stewardship. *Adv Ther*. 2020;37:918-932.
39. Davis UoC. Outpatient Antibiotic Stewardship Program. Vol 2020.
40. Burstein VR, Trajano RP, Kravitz RL, Bell RA, Vora D, May LS. Communication interventions to promote the public's awareness of antibiotics: a systematic review. *BMC Public Health*. 2019;19:899.

AUTHOR BIOGRAPHY

Janice Blanchard, MD, PhD, is Chief, Section of Health Policy, and Professor of Emergency Medicine at George Washington University, Washington, DC.

How to cite this article: Blanchard J, Solaipandian M, John E, et al. Self-prescribing of antibiotics by patients seeking care in Indian emergency departments. *JACEP Open*. 2021;2:e12432.