Social Science Spectrum ISSN 2454-2806
Vol. 4, No. 4, December 2018, pp. 205-213

Prescription Pattern of Antibiotics for Treatment of Acute Illnesses in India: Evidence from IHDS-2

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Abstract

This paper examines the extent of use and socio-economic determinants of antibiotics for treatment of acute illnesses in India. The study uses IHDS-2 (2011-12), a nationally representative sample survey, for analysis. Four acute illnesses are included in the study: fever, cough, cough with short breath and diarrhoea. Bivariate analysis and logistic regression are used to examine the relationship between acute illness and antibiotic use. The overall prevalence rate of acute illness was around 17.4 per cent and was the highest for fever (15.6%) followed by cough (11.7%). Around one-fourth of the patients with acute illness were prescribed antibiotics. The prescription of antibiotic was the highest for cough with short breathe (32.8%), followed by diarrhoea (~27%). The odds of antibiotic prescription were 14 per cent (OR=1.14; 95% CI: 1.04-1.26) and 35 per cent (OR=1.35; 95% CI: 1.11-1.63) higher among individuals aged 5-14 years and 70 or more years compared with children aged less than 5 years. Individuals from the richest quintile were 56 per cent (OR=1.56; 95% CI: 1.42-1.72) more likely to be prescribed antibiotics compared with the poorest quintile individuals. The odds of antibiotic prescription for acute illnesses were 39 per cent lower among private doctors/nurses (OR=0.61; 95% CI: 0.58-0.65) as compared with government doctors/nurses. A higher prescription rate for acute illness, especially diarrhoea, majority of which doesn't require antibiotic therapy indicates that there is a need of awareness programmes and routine surveillance system for antibiotic use along with existing surveillance of antibiotic resistance.

Keywords: Antibiotics use, acute illness, diarrhoea, fever, cough.

I. Introduction

Antibiotic resistance is increasing around the world and largely in developing countries. According to World Health Organization, antibiotic resistance is the result of change in the way microbes (such as bacteria, fungi, viruses and parasites) are exposed to the antimicrobial drugs which results in the ineffectiveness of drugs and infections persist in the body (WHO, 2016). Increased resistance is the result of many factors but the foremost cause is the overall volume of antibiotics consumed. Total antibiotic consumption grew from 50 billion to 70 billion standard units between 2000 and 2010 (Gelband et al., 2015). In most countries, about 20 per cent of antibiotics are used in hospitals and other healthcare facilities, and 80 per cent in community, and half of them are inappropriate for cough and cold which are viral in nature, hence adding to the burden of antibiotic resistance (Kotwani & Holloway, 2011). Unclear knowledge of the hypothesis on causative microbes, adhere to new antibiotics, not prescribing laboratory tests, duration of illness and severity of illness are the major causes of higher prescription of antibiotics (Van Der Meer & Gyssens, 2001).

There is a rise in consumption of antibiotics in India. It has increased from around 4,000 crore in 2005 to 6,500 crore in 2009 (Ganguly et al., 2011). Antibiotics are easily available in India regardless of the person prescribing and even without prescription. The quality of prescription of drugs in terms of layout and content is inadequate (Patel, Vaidya, Naik, & Borker, 2004). In a study

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conducted in a tertiary care hospital in India, it was found that around sixty per cent of the drugs prescribed were not mentioned in the National and State Essential Drugs List and of which 57 per cent were antibiotics (Mohanty et al., 2010). The prevalence rate of prescription of antibiotics varies widely by regions and type of services undertaken. Literatures has documented their irrational use and prescribing pattern in India (Kulkarni et al., 2005). In a study in Nagpur, around one-third of all the drugs prescribed were found to be antimicrobials (Gayathiri, Prabhavathi, Tamilarasi, Vimalavathini, & Kavimani, 2014). The prescription rate of antibiotic was as low as 11 per cent in Kerala (Saradamma, Higginbotham, & Nichter, 2000) to as high as 82 per cent in Lucknow (Kumari, Chandy, Jeyaseelan, Kumar, & Suresh, 2008). A higher proportion of prescription of antibiotics is inappropriate, especially for acute illnesses like fever, cough and cold which are viral (Ceyhan et al., 2010; Kotwani, Chaudhury, & Holloway, 2012; Kumari et al., 2008, Kotwani et al., 2012). In New Delhi, around half of the patients visiting a primary care for acute diarrhoea were prescribed antibiotics. And the prescription was higher in private facilities compared with government facilities. The prescription of antibiotics among children was high with around half of them being prescribed (Kotwani et al., 2012).

Majority of the studies on prescription pattern of antibiotics, especially for acute illnesses, were hospital based or exit surveys by reviewing the prescription of the patients with a relatively smaller sample size conducted in one centre or conducted in selected health facilities. The past studies were conducted in selected departments of a hospitals like paediatric department, ICU, emergency department and medicine department, and further were focused on specific groups of population like children, adult or old. Hence, they could not be generalised to the whole population. Therefore, the current study was aimed to understand the use and socio-economic determinants of antibiotics for treatment of acute illnesses (short-term morbidity) in India using nationally representative sample survey.

II. Methodology

The second round of Indian Human Development Survey (IHDS) conducted in 2011-12 (IHDS-II) was used for analysis in the present study. The IHDS is a nationally representative, multi-topic panel survey. It covered all the states and the union territories except Andaman and Nicobar Islands and Lakshadweep. It covered a total of 42,152 households in 1,503 villages and 971 urban localities. Details of the survey can be found elsewhere (Desai, Vanneman, & NCAER, 2011-12.). In the household questionnaire, heads of the households were asked about the health of the family members which also included information about prevalence of three acute illnesses: fever, cough and diarrhoea in last 30 days prior to the survey. They were further asked about the treatment or advice taken for the same. Inquiry about the type of treatment was categorical and included pain killer/cough syrup, antibiotic, other allopathic medicines, ayurvedic medicines, homeopathy, home/herbal remedy, surgery and others. The present study was based on individuals having any of the selected acute illness and had sought treatment for it.

Description of variables

Dependent variable: The study examines the prescription and determinants of antibiotics for acute illness. Therefore, the use of antibiotics as a treatment for any short-term (acute illness) morbidity was considered as a dependent variable. The type of treatment was categorical in nature with eight categories: pain killer/cough syrup; antibiotic; other allopathic; ayurvedic; homeopathy; home/ herbal remedy; surgery and others. For analysis, it was categorized into two categories: treatment with antibiotic (=1) and treatment with others (=0).

Independent variables: In the survey information on the following acute illnesses were collected: fever, cough and cough with short breath, diarrhoea and diarrhoea with blood. All the acute illnesses were dichotomous with two categories (0= No and 1= Yes). Diarrhoea with blood was excluded as the use of antibiotic is strongly recommended for bloody diarrhoea (Sharma, Sethi, & Gupta, 2009). One combined variable, named, any acute illness (having any of the four

diseases), was created to examine the prescription pattern of antibiotic for treatment of acute illness. The socio-economic attributes used to examine the socio-economic differential in prescription of antibiotics for short-term morbidities includes age, sex, religion, caste, educational status, marital status, wealth quintile, place of residence and the person who gave the advice. Age was classified into six categories based on Global Burden of Disease classification (less than 5 years, 5-14 years, 15-29 years, 30-44 years, 45-69 years and 70+ years). Place of residence was categorized as rural or urban, marital status was classified into three categories (married, unmarried and others). The educational level of the respondent was assessed by the number of completed years of education and was categorized as: 0 years, 1-5 years, 6-10 years, 11 years and above. The economic status of the respondent was assessed using the wealth index created using the available assets in the household. It was categorized into five categories: poorer, poor, middle, rich and richer. Religion of the respondent was categorized into Hindu, Muslim and others, while Caste was classified as: General, other backward classes (OBCs), scheduled castes (SCs) and scheduled tribes (STs).

Statistical tools: The prescription rate of antibiotics was defined as the number of diseased persons prescribed with an antibiotic as a treatment per 100 diseased persons. Group comparison was done using Chi-square test to examine the statistical significance of association between the prescription rate of antibiotics and various socio-economic characteristics. To assess the relationship of various socio-economic and demographic factors with prescription rate of antibiotics, linear logistic regression was used. Three regression models were employed in the study. Model 1 included acute illness only; Model 2 included selected socio-economic and demographic factors of respondents; and Model 3 included both acute illness and socio-economic and demographic factors. Statistical analyses were performed using STATA 13.

III. Results

The overall prevalence rate of any acute illness was estimated to be 17.4 per cent (Table 1). Among the acute illnesses, fever (15.6 %) was found to be most commonly prevalent, followed by cough (11.7%), and was lowest for diarrhoea with 2.7% of prevalence rate. The prevalence rate of any acute illness was higher among females (19.4%) compared with males (15.4%). The prevalence of acute illness was higher among non-literates (24%) and it decreased with advancement in completed years of schooling. The prevalence rate of antibiotics for acute illness showed U-shaped curve with advancement in age being minimum at 15-29 years. As the economic status of the individual improved, the prevalence rate declined (24% among the poorest vs 14% among the richest). The prevalence of treatment seeking behaviour was high for any acute illness and increased between 2004-05 (94.3 %) and 2011-12 (above 96%).

Around one-fourth of the patients with acute illnesses were prescribed antibiotics as the treatment for the morbidity condition (Table 1). The prescription of antibiotics was the lowest in eastern states (19.3%: Bihar, Jharkhand, West Bengal, and Odisha) and was the highest among the north-eastern states (52.74%) (data not shown). The prescription of antibiotics was the highest for cough with short breathe (32.8%), followed by diarrhoea (~27%). The prescription of antibiotic increased with completed years of schooling of the patients. For example, the prescription rate of antibiotics was 24 per cent among non-literates and 26 per cent among individuals with 11 or more years of completed schooling. The prevalence of prescription of antibiotics was higher among older age group and it increased with improved economic condition. For example, the prescription rate was 22 per cent among individuals from the poorest quintile compared with 28 per cent among individuals from the richest quintile.

The odds of reporting any acute illness were higher among females (OR=1.31; 95% CI: 1.28-1.34) compared with males (Table 2). As the completed years of schooling increased, the likelihood of prevalence of any acute illness decreased. For example, individuals with 11 or more completed years of education were 26 per cent (OR=0.74; 95% CI: 0.71-0.78) less likely to report

Table 1: Prevalence of acute illness, its treatment and use of antibiotics for treatment of acute illness in India

Acute illnesses and socio-economic characteristics	**Prevalence of acute illness**		**Treatment seeking for acute illness**		**Antibiotic as treatment of acute illness**	
	%	**N**	**%**	**N**	**%**	**N**
Acute illnesses						
Fever	15.65	32016	97.58	31241	25.26	7861
Cough	11.74	24014	97.01	23296	24.71	5735
Cough with short breath	4.76	9728	98.02	9535	32.81	3118
Diarrhoea	2.66	5443	97.46	5305	26.7	1412
Any acute illness	17.42	35634	96.83	34503	24.91	8593
Socio-economic characteristics						
Sex						
Male	15.41	15723	97.09	15265	25.01	3813
Female	19.42	19911	96.02	19238	24.85	4779
Age group						
<5 years	34.58	7196	98.04	7055	23	1618
5-14 years	19.51	7844	96.88	7599	25.05	1904
15-29 years	12.06	6778	96.46	9538	25.15	1643
30-44 years	14.13	5694	96.28	5482	24.83	1364
45-69 years	17.19	6917	96.56	6679	26.57	1774
70+ years	17.78	1204	95.43	1149	25.2	290
Marital status						
Unmarried	20.25	18728	97.23	18210	24.66	4485
Married	14.53	14367	96.41	13851	25.07	3474
Others[#]	19.22	2537	96.18	2440	25.9	632
Completed years of schooling						
Non-literate	24.1	16219	97.35	15789	23.94	3772
1-5 years	17.76	7711	96.64	7452	24.74	1844
6-10 years	13.19	8269	96.71	7997	25.93	2078
11+ years	11.03	3435	95.05	3265	27.53	898
Religion						
Hindu	17.46	28612	96.81	27700	24.8	6866
Muslim	18.43	5121	97.21	4978	26.4	1315
Others	14.74	1901	96	1825	22.59	411
Caste						
General	16.36	9833	96.12	9451	26.19	2472
OBCs	17.87	14998	97.72	14656	23.61	3464
SCs/STs	17.85	10803	96.23	10396	25.6	2656
Wealth Quintile						
Poorest	23.82	6845	95.94	6567	21.62	1417
Poor	20.07	7589	96.96	7358	21.58	1587
Middle	17.31	7592	96.93	7359	25.09	1844
Rich	15.17	6855	97.33	6672	28.19	1881
Richest	13.8	6738	96.96	6533	28.4	1858
Place of residence						
Rural	18.26	24667	96.77	23871	24.02	5724
Urban	15.79	10967	96.95	10632	26.93	2868
Total	17.42	35634	96.83	34503	24.91	8562

Includes separated, divorced and widowed.

Table 2: Adjusted odds ratios for prevalence of any acute illness and its treatment seeking by selected socio-economic characteristics in India

Socio-economic characteristics	Adjusted OR for acute illnesses (95% CI)	Adjusted OR for treatment of acute illness (95% CI)
Sex		
Male	1	1
Female	1.31* (1.28-1.34)	0.84** (0.75-0.96)
Age group		
<5 years	1	1
5-14 years	0.54* (0.51-0.56)	0.77** (0.59-0.99)
15-29 years	0.34* (0.32-0.36)	0.87 (0.65-1.16)
30-44 years	0.40* (0.37-0.43)	0.74 (0.52-1.06)
45-69 years	0.48* (0.45-0.51)	0.75 (0.53-1.07)
70+ years	0.47* (0.43-0.51)	0.54* (0.35-0.83)
Completed years of schooling		
Non-literate	1	1
1-5 years	0.86* (0.83-0.89)	0.77* (0.64-0.94)
6-10 years	0.75* (0.72-0.77)	0.74* (0.62-0.90)
11+ years	0.74* (0.71-0.78)	0.44* (0.34-0.56)
Marital status		
Unmarried	1	1
Married	0.92* (0.88-0.97)	0.89 (0.69-1.15)
Others[#]	0.96 (0.89-1.04)	0.87 (0.61-1.25)
Religion		
Hindu	1	1
Muslim	0.96*** (0.93-1.00)	1.03 (0.85-1.25)
Others	0.95*** (0.91-1.01)	0.81 (0.64-1.04)
Caste		
General	1	1
OBCs	0.98 (0.95-1.01)	1.73* (1.48-2.02)
SCs/STs	0.90* (0.87-0.93)	1.08 (0.92-1.27)
Wealth Quintile		
Poorest	1	1
Poor	0.84* (0.81-0.87)	1.43* (1.19-1.71)
Middle	0.72* (0.69-0.75)	1.52* (1.26-1.83)
Rich	0.62* (0.59-0.65)	1.95* (1.57-2.41)
Richest	0.57* (0.54-0.59)	2.05* (1.62-2.60)
Place of residence		
Rural	1	1
Urban	1.11* (1.07-1.14)	0.91 (0.78-1.07)

Includes separated, divorced and widow; * p-value<0.01; ** p-value<0.05; *** p-value<0.1.

any acute illness compared with those who were non-literates. The odds of reporting any acute illness were higher among lower age group population. Compared with children aged less than 5 years, children aged 5-14 years and elder aged 70+ years were 46 per cent (OR=0.54; 95% CI: 0.51-0.56) and 53% (OR=0.47; 95% CI: 0.43-0.51) less likely to report any acute illness respectively. The odds of reporting acute illness decreased with improvement in economic strata: individuals from the richest quintile were 43 per cent (OR=0.57; 95% CI: 0.54-0.59) less likely to report any acute illness. The odds of seeking treatment for any acute illness were lower among females (OR= 0.84; 95% CI: 0.75-0.96) compared with males. The odds of seeking treatment for acute illnesses declined with improved educational status. For example, the individuals with 1-5 and 11 or more years of completed schooling were 14 per cent and 26 per cent less likely to seek treatment for any acute illness compared with non-literates. Individual with acute illness from the richest quintile were twice (OR=2.05; 95% CI: 1.62-2.60) more likely to take treatment for any acute illness compared with individuals from poorest quintile.

Table 3: Adjusted odds ratios of antibiotic use for treatment of acute illness by selected socio-economic and demographic characteristics.

Illness and socio-economic characteristics	Model 1: Acute illness Adjusted OR (95% CI)	Model 2: Socio-economic characteristics Adjusted OR (95% CI)	Model 3: Combined Adjusted OR (95% CI)
Fever			
No	1		1
Yes	1.26* (1.16-1.38)		1.32* (1.21-1.45)
Cough			
No	1		1
Yes	0.70* (0.66-0.74)		0.71* (0.66-0.75)
Cough with short breath			
No	1		1
Yes	2.06* (1.94-2.19)		2.14* (2.01-2.27)
Diarrhoea			
No	1		1
Yes	1.08** (1.01-1.16)		1.13* (1.05-1.21)
Sex			
Male		1	1
Female		0.98 (0.93-1.04)	0.99 (0.94-1.04)
Age group			
<5 years		1	1
5-14 years		1.14* (1.04-1.26)	1.22* (1.11-1.35)
15-29 years		1.19* (1.06-1.35)	1.28* (1.13-1.44)
30-44 years		1.30* (1.12-1.50)	1.39* (1.20-1.61)
45-69 years		1.44* (1.25-1.66)	1.49* (1.29-1.72)
70+ years		1.35* (1.11-1.63)	1.34* (1.10-1.63)
Completed years of schooling			
Non-literate		1	1
1-5 years		0.97 (0.90-1.05)	0.98 (0.91-1.06)
6-10 years		1.01 (0.93-1.09)	1.02 (0.94-1.10)
11+ years		0.99 (0.89-1.11)	1.01 (0.91-1.13)
Marital Status			
Unmarried		1	1
Married		0.85* (0.76-0.95)	0.84** (0.75-0.94)
Others[#]		0.87 (0.75-1.03)	0.86*** (0.73-1.01)
Religion			
Hindu		1	1
Muslim		1.17* (1.09-1.26)	1.15* (1.07-1.24)
Others		0.76* (0.67-0.85)	0.75* (0.66-0.84)
Caste			
General		1	1
OBCs		0.94** (0.88-0.99)	0.94*** (0.88-1.00)
SCs/STs		1.14* (1.07-1.23)	1.15* (1.07-1.24)
Wealth Quintile			
Poorest		1	1
Poor		1.01 (0.93-1.09)	1.03 (0.95-1.13)
Middle		1.25* (1.15-1.35)	1.30* (1.19-1.41)
Rich		1.51* (1.38-1.64)	1.56* (1.43-1.71)
Richest		1.56* (1.42-1.72)	1.65* (1.50-1.82)
Place of residence			
Rural		1	1
Urban		0.95 (0.89-1.01)	0.98 (0.92-1.04)
Who gave advice			
Govt. doc/nurse		1	1
Private doc./nurse		0.61* (0.58-0.65)	0.60* (0.57-0.64)
Others[$]		0.85* (0.78-0.94)	0.89** (0.82-0.98)

[#] includes separated, divorced and widow; [$] includes chemist, *vaidhya/hakim*, witchcraft and others; * p-value<0.01; ** p-value<0.05; *** p-value<0.1.

Among all the selected short-term morbidities, the odds of prescription of antibiotic as a treatment were higher for cough with short breath (OR=2.06; 95% CI: 1.94-2.19) (Table 3: Model 1). However, the odds for prescription of antibiotics was lower for individuals with cough (OR=0.7; 95% CI: 0.66-0.74) compared with those who didn't. There was no significant difference in prescription of antibiotic for any acute illness by gender, years of schooling of individuals and place of residence (Model 2). The odds of antibiotic prescription for acute illness was 0.85 times lower (OR=0.85; 95% CI: 0.76-0.95) among married individuals compared with unmarried individuals. The odds of reporting antibiotic prescription as treatment was found to increase with advancement in age. For example, the odds of antibiotic prescription was 14 per cent (OR=1.14; 95% CI: 1.04-1.26) and 35 per cent (OR=1.35; 95% CI: 1.11-1.63) higher among individuals aged 5-14 years and 70 or more years respectively compared with children aged less than 5 years. The odds of antibiotic prescription also increased with improved economic strata: richest quintile individuals were 56 per cent (OR=1.56; 95% CI: 1.42-1.72) more likely to be prescribed antibiotic for acute illness compared with the poorest quintile individuals. Compared with government doctors/nurses, private doctors/nurses (OR=0.61; 95% CI: 0.58-0.65) were less likely to prescribe antibiotics for treatment of acute illness. The combined model (Model 3) shows similar results as Model 2, with slightly higher odds.

IV. Discussion and conclusion

Antibiotic resistance of pathogens is associated with an increased risk of infection among subjects taking an antibiotic drug for unrelated reasons (Barza & Travers, 2002). The increased resistance is a result of many factors, but the foremost cause is the overall volume of antibiotics consumed (WHO, 2016) Consumption of antibiotics has increased over time, and they are easily available in India regardless of person prescribing, and even without prescription (Ganguly et al., 2011). Further, a majority of the antibiotic prescription/use in India is irrational and inappropriate (Kulkarni Ra et al., 2005). The present study examines the prescription/use and socio-economic determinants of antibiotics for the treatment of acute illnesses: fever, cough, cough with short breath and diarrhoea.

Around one-fourth of the patients of acute illnesses were prescribed antibiotics for the treatment of any kind of acute illness. This prescription rate was in the range found in various studies in India, varying from 11 per cent to 86 per cent (Saradamma et al., 2000). Geographic variation was observed which might be attributed patients' education, doctors' and pharmacists' knowledge, severity of illness and access to health care and diagnostic facility (Chandy et al., 2013). Prevalence of higher prescriptions of antibiotics was higher in urban areas than rural areas and also the government doctors/nurses were more likely to prescribe them for acute illnesses than private doctors/nurses. Past studies have also recorded variation in the prescription pattern of antimicrobials across types of health facilities, and rural-urban settings (Chandy et al., 2013; Kumari India et al., 2008; Sharma et al., 2009). Income disparity was observed in the prescription/use of antibiotic for acute illnesses. The patients with higher completed years of education and from richer strata were more likely to be prescribed with antibiotics for acute illnesses which might be due to higher purchasing power and persistent requests for their prescription by the individuals and the results are in accordance with the past studies (Kotwani et al., 2012).

The antibiotics were prescribed more frequently for respiratory infections (cough with short breath), followed by diarrhoea and higher among children despite recommendation to the contrary. According to WHO, acute respiratory infection (ARI), acute watery diarrhoea (ADD) and viral fever are the common childhood illnesses accounting for most paediatric outpatient visits. Of them, only a small proportion (<20%) require antibiotic therapy. The findings of this study are consistent with findings in the literature (Chandy et al., 2013; Kotwani et al., 2012; Steinman, Landefeld, & Gonzales, 2003). Past studies have shown inappropriate use of antibiotics, especially the broad-spectrum of antibiotics for these common childhood illnesses which has contributed largely to the development of antibiotic resistance. In the current study, one-fifth of the children with acute

illnesses were prescribed antibiotics for treatment (Ceyhan et al., 2010). Adverse effects of the early exposure of antibiotics among children is debated. Some studies have established the relationship between early exposure to antibiotics and asthma (Kuo et al., 2013; Mai, Kull, Wickman, & Bergström, 2010). More than one-fourth of the patients with diarrhoea were prescribed antibiotics. But according to WHO and local standard treatment guidelines, for acute diarrhoea in adults antibiotics are not recommended (Sharma et al., 2009; WHO, 2005) as viral pathogens such as rotavirus account for 70-80 per cent of all diarrhoeal episodes (Thapar & Sanderson, 2004). Further, some other side effects of antibiotic associated diarrhoea (AAD) due to antibiotic use for diarrhoea were studied and increased prevalence of ADD was observed (Alam & Mushtaq, 2009).

In the present study household head was asked about the short-term morbidity for the household members. It is possible that the household head may not be aware of many cases for which treatment was sought. Further, the knowledge of the type of treatment taken may not be known to him for all the members. Hence, the estimates in the current study may be on lower side. Estimates of the use of antibiotics for the treatment of acute illness may be much higher as only those individuals were considered who had sought advice or medical treatment for the acute illness. The estimates will increase after considering self-medication, purchasing from counter and use of leftovers as antibiotics are easily available from counters especially for headache, fever, and respiratory tract infections (Ahmad, Patel, Mohanta, & Balkrishnan, 2014; Skliros et al., 2010).

As the use of antibiotics is increasing in India, the risk of antibiotic resistance is high. Many developed countries have established the surveillance system not only to monitor it (Felmingham et al., 2005) but also their use (Coenen et al., 2007). In India, there are national surveillance networks for antibiotic resistance (Thomas, 1999) but the surveillance is not well established (Chandy et al., 2013). This will ensure accurate information to modify treatment guidelines and aid in the prescription of appropriate empirical antimicrobial therapy (Masterton, 2008). Region-specific surveillance may be more useful as wide geographical variations exist in the prevalence of antibiotic use. Interventions like antimicrobial utilization programme at hospitals and community level might be helpful in reducing the use of inappropriate antimicrobial drugs. Awareness programmes be made public as they are useful in developing a comprehensive picture of antibiotic use and its consequences (Fonseca, Santos, Costa, Lencastre, & Tavares, 2012).

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