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Antibiotics prescribing patterns and incidence of respiratory tract infection in children under five years: A study in two hospitals in Accra, Ghana

John Antwi Apenteng[1*], Bright Selorm Addy[2], Emmanuel Ogbu Onwukwe[1] and Marianne Gloria Brookman-Amissah[1]

[1]Department of Pharmaceutics, School of Pharmacy, Central University, Accra, Ghana.
[2]Department of Pharmacology and Toxicology, School of Pharmacy, Central University, Accra, Ghana.

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Respiratory tract infections are known to have the highest incidence and mortality rates especially among children in developing countries. Antibiotic use is common in respiratory tract infections (RTI); however, increased rates of antibiotic resistance development have prompted studies on prescribing patterns and recommendations for appropriate antibiotic use. This study aims at monitoring prescription patterns of antibiotics for respiratory tract infection in children and establishing a relationship between child ageing and respiratory disease occurrence at Ridge Hospital and Adabraka Polyclinic in Accra, Ghana. The study involved patients age five years and below with RTI cases presented at the two health facilities from January, 2014 to February, 2016. Data was obtained from patient medical folders. Antibiotic treatment for every respiratory diagnosis was compared to recommendations for each diagnosis. Appropriateness of antibiotic prescription was also assessed using a standard criterion. To identify the relationship between ageing in children and respiratory disease incidences, cases were grouped by their ages and the number of cases presented for each age group was counted. Results revealed that, 70.37% of cases from the childrens' ward of Ridge Hospital with specific diagnoses had antibiotics prescribed appropriately, whilst 29.63% of cases had antibiotics prescribed inappropriately. Also, 34.62% of cases with specific diagnoses from the out-patient department (OPD) of Adabraka Polyclinic resulted in appropriate antibiotic prescription whilst 65.38% had antibiotics prescribed inappropriately. The results obtained indicated an overall decrease in the incidence of RTIs as children aged.

Key words: Prescribing patterns, antibiotic resistance, respiratory tract infections, antibiotics.

INTRODUCTION

Respiratory disease is the medical term that describes diseases affecting organs and tissues involved in gaseous exchange possibly in higher organisms. When the causative agent is a microorganism, it is known as a respiratory tract infection (RTI) which can be further classified into upper and lower respiratory tract infections

*Corresponding author. E-mail: j.a.apenteng@gmail.com, japenteng@central.edu.gh. Tel: +233 249449249, +233 547165573.

(URTI and LRTI respectively). Upper respiratory tract infections include; rhinitis, sinusitis, nasopharyngitis, epiglottitis and laryngitis. Lower respiratory tract infections include; pneumonia, bronchitis, tuberculosis and asthma. Other respiratory tract infections are pertussis which is caused by *Bordetella pertussis* which can be worsened by protein malnutrition and cerebral hypoxia. Secondary bacterial infections may also occur (Ministry of Health, Ghana, 2010).

It is estimated that in the first two years of life, every child experiences 8 to 9 episodes of respiratory infections annually, however, progression to acute phase occurs much more frequently in children in developing countries. A recent median global estimate of pneumonia in children under five years shows about 150.7 million new cases yearly (Rudan et al., 2004). A study in the United States in 2012 revealed that respiratory conditions were the most frequent reasons for hospital stays among children (Witt et al., 2014) Acute respiratory infections (ARI) are the leading cause of mortality in children under five years of age accounting for 22% of deaths in children worldwide, with pneumonia as the single leading cause of death (Bryce et al., 2005; WHO, 2009). With approximately 1.4 to 1.8 million fatal cases per year in children under the age of five, pneumonia causes more fatalities than AIDS, malaria, and measles combined (WHO, 2011; Black et al., 2010) with 70% of these deaths occurring in Africa and Asia, however, the epidemiology of RTIs in these countries remains incomplete, with large gaps in morbidity and mortality data (World Bank, 2006).

In Ghana, RTI is the second common outpatient diagnosis after malaria (Accra Metropolitan Assembly, Ghana, 2015). Research has shown that over half of all patients presented with respiratory tract infections were treated with antibiotics although majority of the cases had viral causes (Picazo et al., 2003). Responsible use of antibiotics require that patients receive antibiotics appropriate to their clinical need, in doses that meet their individual requirements for an adequate period of time and at the lowest cost to their community. Antibiotics are among the most prescribed medicines in the world but rapid development of antibiotic resistance has led to the need for a closer look into prescribing patterns. A study was carried out by members of the National Center for Health Statistics under the American Health Association aimed at identifying the conditions for which clinicians prescribe antibiotics to children most frequently and to characterize the antibiotic prescribing practices for conditions that do not typically benefit from antibiotics (colds, URIs, and bronchitis) (Nyquist et al., 1998; Gadomski, 1993; Hamm et al., 1996). The team evaluated prescriptions from office visits by patients younger than 18 years of which patients with underlying lung diseases such as chronic bronchitis were excluded to eliminate sets of patients for which antibiotic therapy might be justified. Continuous monitoring of prescriptions may help in identifying problems involved in therapeutic decisions and promote rational prescribing (Kaur and Walia, 2013; Saeeda et al., 2012). It is thus important to evaluate and monitor the drug utilization patterns from time to time, to enable suitable modifications in prescribing patterns to increase the therapeutic benefit.

This study is aimed at assessing the appropriateness of antibiotic prescribing for respiratory tract infection by doctors in two different health facilities in Accra, Ghana and also determines the incidence of the disease in children below five years.

MATERIALS AND METHODS

Study setting and type

Data for the study was gathered from Ridge Hospital and Adabraka polyclinic in Accra. Ridge hospital is the regional hospital of the Greater Accra region of Ghana and is located at Roman Ridge in Accra. Ridge hospital was formerly merged with Adabraka polyclinic which was known as Ridge Hospital OPD (out-patient department) located in Adabraka in Accra and was responsible mainly for out-patient cases whereas ridge hospital dealt with in-patient cases. Adabraka polyclinic is now independent of Ridge Hospital but still takes care of mostly out-patients. The study was a retrospective and cross-sectional one.

Ethical clearance

Ethical approval was received from the Greater Accra Regional Health Directorate as well as the research ethics committee of the health institutions before the start of the study.

Inclusion criteria

Data was gathered from the children's departments of both health facilities. Medical records of children five years of age or younger were gathered and data from cases of respiratory diseases from January 1, 2014 to February 2016 were recorded. Data that could influence the prescription of antibiotics such as the patient's symptoms and diagnoses as well as antibiotics prescribed and dosage regimen were recorded. In-patient cases were recorded from Ridge hospital children's ward whilst out-patient cases were recorded from Adabraka Polyclinic. Data was recorded from eighty (80) cases overall with forty (40) cases from each health facility. The data was recorded into a questionnaire in the form of a table.

Exclusion criteria

Data from patients older than five years was not included in the study with the aim of narrowing the focus of the study to the age group most affected by respiratory tract infections. Cases older than January 1, 2014 were also excluded from the study to ensure that results obtained reflect more recent events and to ensure availability of data.

Data analysis

For statistical purposes, data from the questionnaire were compiled in a table as used in the study by Koranye (2013) whilst graphs and

other statistical analysis were performed using Microsoft Office Excel. Appropriateness of treatment was determined by the extent of adherence to the Ghana Standard Treatment Guideline (STG) (Ministry of Health, Ghana, 2010) recommendations as the standard guideline for healthcare in the country at the time the study was undertaken. Based on the comparison, each case was classified according to Kunin et al. (1973) criteria, modified by Deshmukh et al. (2015).

It is important to note that in as much as this research is important, data and results from only two health facilities may be insufficient to make general conclusions for all health facilities in Accra, Ghana.

Kunin et al. (1973) criteria for assessing appropriateness of antibiotic use modified by deshmukh et al. (2015)

Category I

Antibiotic therapy in the prescription agrees with recommendation for that diagnosis. The treatment is appropriate in terms of choice of prescription or no prescription of antibiotics, the appropriate antibiotic, dose, dosage regimen, and duration of therapy. This category represents the most appropriate use of antibiotics.

Category II

Antibiotic therapy in the prescription agrees with recommendation for that diagnosis due to the presence of other non-respiratory related infections which could be of bacterial origin or when a potentially fatal infection cannot be ruled out. This category also represents the appropriate use of antibiotics because the presence of more than one infection or a severe diagnosis means a higher risk of mortality and saving the patient's life takes priority over antibiotic misuse.

Category III

Antibiotic therapy in the prescription agrees with recommendation for that diagnosis but a different, less toxic therapy with less disadvantages and less likelihood of resistance is preferred. Although antibiotic therapy is recommended in these cases, non-antibiotic therapy or a different antibiotic than the one prescribed is preferred. Cases in this category fall under inappropriate use of antibiotics

Category IV

Antibiotic therapy in the prescription agrees with recommendation for that diagnosis but a modified dose, dosage regimen, and duration would be recommended. For cases in this category, antibiotic treatment is recommended for the diagnosis and the choice of antibiotics agrees with recommendations; however the dose, dosage regimen or duration of antibiotic therapy do not agree with recommendations. Due to the high correlation between inappropriate dose, dosage regimen and duration of antibiotic therapy with development of resistance to antibiotics and therapy success or failure, cases in this category are considered inappropriate antibiotic use. For antibiotics that are dosed on a weight basis, only the duration of antibiotic use in the prescription were accounted for in determining appropriateness of use. This is because; the patients' weights were not recorded in most folders. For oral preparations of cefuroxime and ceftriaxone, the dose, dosage regimen, and duration were not accounted for in determining appropriateness of use due to the unavailability of these dosage forms at the time the guidelines were set.

Category IV

Antibiotic therapy in the prescription disagrees with recommendation for that diagnosis. For cases in this category, there is no justified cause for administration of antibiotics to the patient based on his or her diagnosis. Record of other infections and severe or potential fatal condition is absent in these cases. This category represents the most inappropriate use of antibiotics.

RESULTS

Respiratory conditions diagnosis at Ridge hospital included; bronchial pneumonia, pharyngitis, tonsillitis, bronchitis, asthma and URTI (Table 1). Conditions such as URTI, common cold, Pertussis, asthma and acute bronchitis were the main diagnosis at Adabraka Polyclinic (Table 2). At the two facilities, both oral and parenteral antibiotics were prescribed. Parenteral antibiotics were mostly prescribed at Ridge Hospital.

Data gathered from Ridge Hospital (in-patients) folders is shown in Table 1 while data gathered from Adabraka Polyclinic (out-patients) folders is given in Table 2.

Relationship between ageing and respiratory disease occurences in children

The study showed a relationship between the incidence of respiratory disease and the age of the children. It was observed that, the incidence of RTI decreased as the children aged. This was observed in both health facilities as shown in Table 3 and Figure 1.

Assessing the extent of responsible antibiotic use in each health facility

The prescribing pattern of antibiotics at the two health facilities is summarized in Tables 4 and 5. The nature of the diagnosis, antibiotic given and the relevance for antibiotic treatment or not have been indicated and classified according to Kunin et al. (1973) criteria for assessing appropriateness of antibiotic use, modified by Deshmukh et al. (2015). In Tables 4 and 5, under "STG recommends antibiotic(s) for this diagnosis" column, N/A signifies that, since the patient diagnosis was not specific, there is no available recommendation for or against antibiotic use, while, under "Severe/Life threatening condition" column, N/A signifies that the patient diagnosis is not indicated as severe in the medical folder and infections with high mortality rates such as Pneumonia (WHO, 2009; WHO, 2011; Black et al., 2010) are not included in the patient diagnosis; and under "Criteria for appropriate use of antibiotics" column, N/A signifies that since the patient diagnosis was not specific and there is

Table 1. Sample of Data obtained from Ridge Hospital (In- patient) folders.

Case number	Date of Rx	Age	Respiratory symptoms	Diagnosis	Other(non RTI) symptoms which could be caused by bacterial	Antibiotic(s) prescribed	Dosing
1	12/04/15	10m	Rapid breath, wheezing	Asthma	None	None	None
2	01/02/16	1y10m	Fever, cough, fast pulse	Non-specific Gastroenteritis		IV Cefuroxime	210mg 8hrly*1
3	03/12/15	1m	Fever, cough, nasal discharge, fast pulse	URTI	Vomiting, diarrhea	None	None
4	03/02/16	1y	Fever, cough ,vomiting	Pertussis	Diarrhea	Syr. Cefuroxime	N/A
5	25/02/15	1y4m	Fever, cough, nasal discharge, fast pulse	Bronchitis Pneumonia	Skin rashes	Susp Zinnat 125/5 Antibacterial cream	80 mg 12 hrly * 7
6	01/02/16	2y3m	Fever, cough, runny nose, muscle aches, sore throat, Rhinorrhea	Pharyngitis Tonsilitis	Vomiting, abdominal pain	IV Zinnacef 30 mg/kg	330 mg 8hrly
7	04/12/14	8m	Fever, cough, Rhinorrhea	Bronchitis	None	Susp. Amoksiklav	228mg/5ml bd * 7
8	23/07/14	3m	Fever, rapid breathing, fast pulse, Cyanosis	Pneumonia	Vomiting, diarrhea	Susp. Amoksilav Syr. Ceftriaxone	457 mg/5ml bd *7 2.5mls dly*10
9	07/01/16	2y11m	Fever, nasal congestion, rhinorrhea, breathlessness	Common cold (Viral URTI)	Vomiting	None	None
10	29/01/16	3y	Fever, cough, chest pain, breathlessness, fast pulse	Pneumonia URTI	Vomiting	IV Ceftriaxone IV Metronidazole	880mg dly *3 80 mg *3

no available recommendation for or against antibiotic use, the case does not fall under any of the categories in the criteria for appropriate use of antibiotics.

Criteria for appropriate use of antibiotics

The results showed that the total number of cases where antibiotics were prescribed was higher at Adabraka Polyclinic (82.5%) than at Ridge Hospital (67.50%), however, the total numbers of specific diagnosis were almost similar (Table 6). Ridge Hospital had a high number of cases where antibiotics were appropriately been prescribed (70.37%) while 29.63% of the cases had antibiotics inappropriately prescribed.

DISCUSSION

Relationship between ageing in children and respiratory disease occurences

In this study, the results obtained indicates an overall decrease in the reported cases and thus the incidence rate of respiratory tract infections as patients age from zero to five years. This was evident in the downward sloping line of best fit in Figure 1. These results are consistent with research by Chan et.al, (2015), which studied viral respiratory diseases in Hong Kong and discovered a similar decrease in respiratory tract infections as children age. This is possibly as a result of maturing respiratory tissues and organs which help the child to cope better with the symptoms. Exposure to antigens at young age also strengthens the immune system triggering immune responses to fight off infection-causing micro-organisms leading to reduced incidence of respiratory diseases as they age.

Comparing antibiotic prescribing in the health facilities

Ridge Hospital had fewer cases of antibiotic prescriptions (67.5%) as compared to Adabraka

Table 2. Sample of data obtained from Adabraka polyclinic (out-patient) folders.

Case number	Date of Rx	Age	Respiratory symptom	Diagnosis	Other(non RTI) symptoms which could be caused by bacterial	Antibiotic(s) prescribed	Dosing
1	30/01/16	1m	Cough, rhinorrhea	Rhinitis	None	None	None
2	24/02/14	1y	Fever, cough, rhinorrhea	Rhinitis	None	None	None
3	04/01/15	1y10m	Fever, cough, swollen tonsils, fast pulse	Tonsillitis	Conjunctivitis, Parotitis, Rashes	Susp. Amoksilav Syr. Ceftriaxone	228mg/5ml bd * 7 2.5mls dly*10
4	29/09/15	6m	Cough	Non-specific	None	Susp. Amoksilav	228mg/2-5ml bd * 7
5	10/04/14	2y	Fever, nasal congestion	Common cold	Diarrhoea,rashes Vomiting	Susp. Amoksilav Syr. Ceftriaxone	457 mg/5ml bd *7 2.5mls dly*10
6	29/01/16	8m	Fever, cough, vomiting	Pertussis	Diarrhea	None	N/A
7	01/02/16	2y	Fever, nasal congestion	Common cold	Rashes , vomiting	Susp. Amoksilav Syr. Cefuroxime	457 mg/5ml bd *7 2.5mls dly*10
8	08/12/15	3y	Cough	Non-specific	None	Susp. Amoksilav	457 mg/5ml bd *7
9	17/04/15	6m	Fever, cough,sore throat	Pharyngitis	Vomit	Syr. Amoksilav	228mg bd * 7
10	30/10/15	1y	Fever, cough, rhinorrhea	Acute Bronchitis	Conjunctivitis	None	N/A

y = years; dly =daily; Susp = Suspension; m = months ; hrly = hourly ; Syr = Syrup; URTI = Upper Respiratory Tract Infection; bd = twice a day; IV = Intravenous.

Table 3. The distribution of respiratory diseases presented by different age groups of children 5 years old or younger in both health institutions.

Age group year (yr) and months (m)	Incidence of respiratory diseases		Total number of reported RTI cases
	Ridge Hospital (in-patients)	Adabraka Polyclinic (out-patients)	
<6m	7	6	13
6m-<1yr	6	8	14
1yr-<1yr6m	8	6	14
1yr6m -<2yr	5	5	10
2yr-<2yr6m	6	5	11
2yr6m -<3yr	3	3	6
3yr-<3yr6m	2	3	5
3yr6m-<4yr	1	1	2
4yr-<4yr6m	1	1	2
4yr6m-5yr	1	2	3
Total	40	40	80

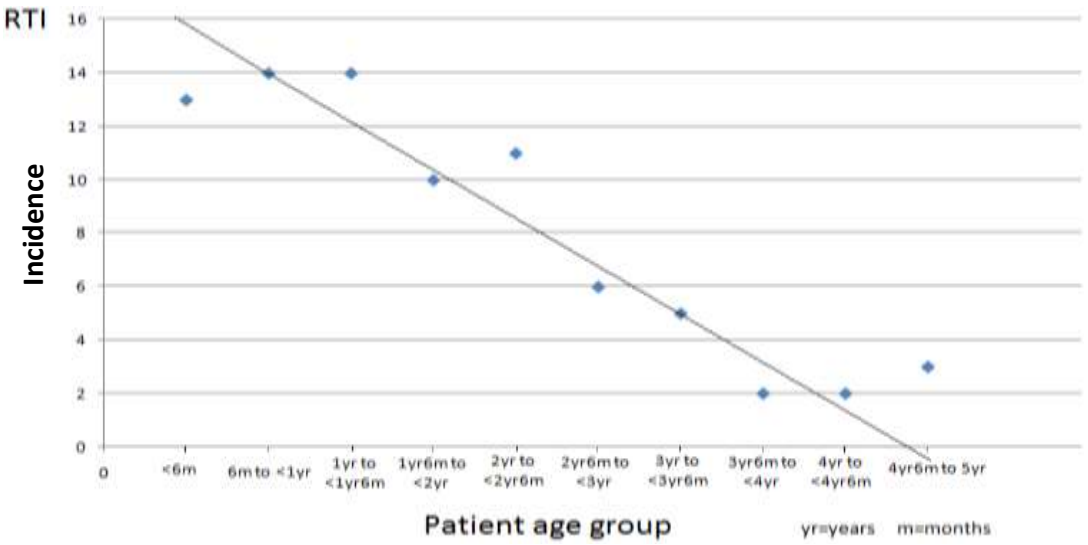

Figure 1. Scatter diagram with line of best fit showing the distribution of respiratory diseases presented by different age groups of children under 5 years who reported at the health institutions.

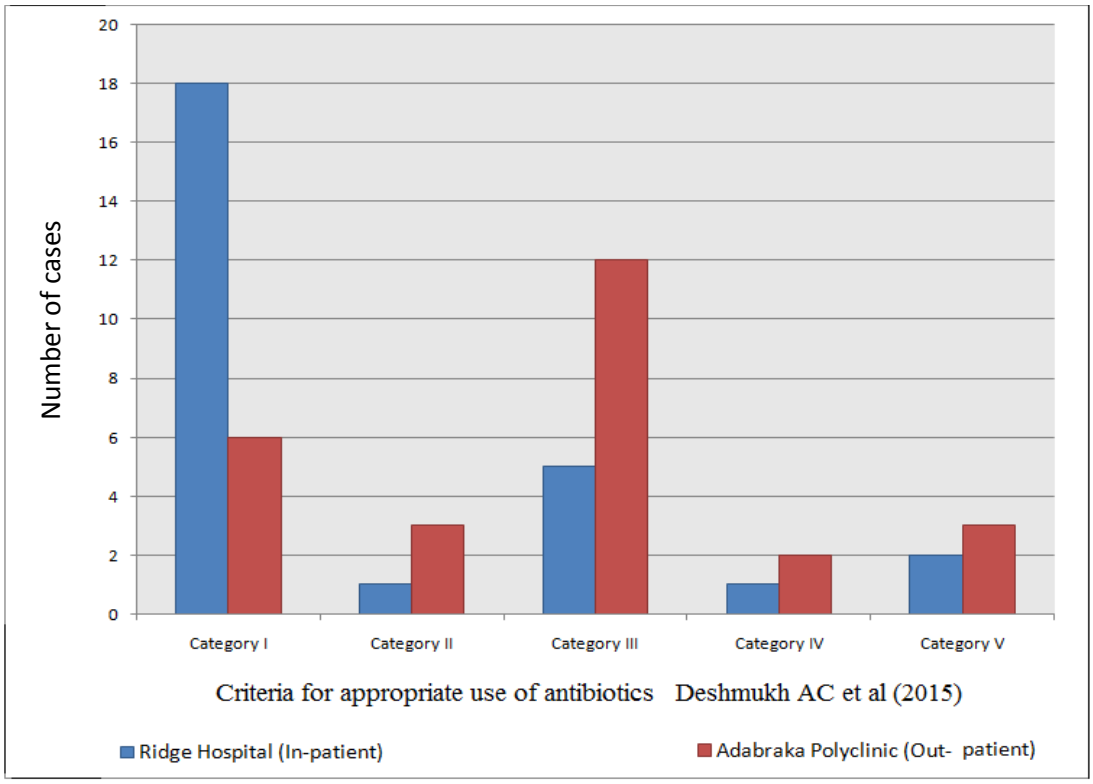

Figure 2. Distribution of cases from the health facilities under the criteria for appropriate use of antibiotics.

polyclinic (82.5%) cases. This is consistent with results obtained from research carried out by the members of the Disease Control and Prevention Development under the Ghana Health Service who found that antibiotic prescriptions were higher in health centers or clinics than in hospitals (Ahiabu et al., 2015). Ridge Hospital had slightly higher cases with specific diagnosis; thus 67.5% of cases as compared to Adabraka Polyclinic with 65%.

Table 4. The statistical representation of data from Ridge Hospital (in-patients).

Diagnosis No.	Specific (0/1)	STG recommended antibiotic (0/1)	Severity (0/1)	Other infection (0/1)	Antibiotics given (0/1)	Prescription matched STG			Criteria					
						None	Name	Dose/duration	I	II	III	IV	V	N/A
1	1	0	N/A	0	0	1			1					
2	0	N/A	N/A	1	1									1
3	0	N/A	N/A	1	0									1
4	1	1	N/A	1	1		0	0			1			
5	1	1	1	1	1		1	1	1					
6	1	1	1	1	1		0	0			1			
7	1	1	N/A	0	1		1	1	1					
8	1	1	1	1	1		1	1	1					
9	1	0	N/A	1	0	1			1					
10	1	1	1	1	1		1	1	1					
11	1	1	N/A	0	1		0	0			1			
12	1	1	1	1	1		1	1	1					
13	0	N/A	N/A	0	1									1
14	1	1	1	1	1		1	1	1					
15	0	N/A	N/A	0	0									1
16	0	N/A	N/A	1	1									1
17	1	0	N/A	1	1	0				1				
18	1	1	1	1	1		1	1	1					
19	0	N/A	N/A	0	1									1
20	1	1	N/A	1	0								1	
21	1	0	N/A	0	0	1			1					
22	0	N/A	N/A	0	0									1
23	1	1	1	0	1		1	1	1					
24	1	1	1	1	1		1	1	1					
25	1	1	1	1	1		1	1	1					
26	1	1	N/A	0	1		1	0				1		
27	0	N/A	N/A	0	0									1
28	1	1	N/A	1	1		0	0			1			
29	1	1	1	0	1		1		1					
30	1	0	N/A	0	0	1			1					
31	0	N/A	N/A	1	1									1
32	0	N/A	N/A	0	1									1
33	1	1	1	1	1		1		1					
34	1	0	N/A	0	0	1			1					
35	0	N/A	N/A	0	0									1

Table 4. Cont`d.

36	1	1	N/A	1	1		0	0		1				
37	0	N/A	N/A	0	0									1
38	1	0	N/A	0	0	1			1					
39	1	0	N/A	0	1	0							1	
40	0	N/A	N/A	1	1									1

(0/1) = 0 or 1; 0 = the case does not fall under this category; 1 = the case falls under this category; N/A = Not available.

Quite a high number of cases (70.37%) from Ridge Hospital with specific diagnoses had antibiotics prescribed appropriately by recommendation from the Standard Treatment Guidelines (STG) whilst 29.63% of cases were prescribed inappropriately**.** On the other hand, 34.62% of cases with specific diagnoses from Adabraka Polyclinic resulted in appropriate antibiotic prescription whilst 65.38% were prescribed inappropriately. The result shows that for children aged five years and below with respiratory diseases, responsible antibiotic prescription is practiced at Ridge Hospital more than Adabraka Polyclinic (Figure 2). One reason for the comparatively higher rates in Ridge Hospital cases is the availability of more qualified physicians and specialists in the facility than lower level facilities such as clinics and the health centres. These physicians and specialists are more knowledgeable compared to their counterparts in clinics and health centres hence the appropriate prescription of medications in these hospitals is higher. Hospitals are also better funded compared to clinics and are therefore more likely to have adequate and modern rapid diagnostic tools resulting in quicker and more specific diagnoses as well as more appropriate antibiotic prescription. Less funding also results in a higher patient-to-doctor ratio in the clinic resulting in inadequate time to diagnose and assess the need for antibiotics for each patient. Another possible reason for more responsible antibiotic use observed at Ridge Hospital could be that cases were obtained from the in-patient department whereas cases from Adabraka Polyclinic were from the out-patient department. The in-patient department treats more complicated, severe and chronic conditions whilst the out-patient departments treat more acute infections. For all complicated, severe and chronic conditions, antibiotics are recommended for treatment and thus prescribing antibiotics for these diagnoses is likely to fall under appropriate antibiotic use. On the other hand, antibiotics are not recommended for some acute diagnoses and this makes out-patient cases more likely to be treated with antibiotics inappropriately. Varying results have been obtained on what constitutes irresponsible antibiotic use according to research carried out in Australia (Ahiabu et al., 2015) to access efficacy of antibiotics in paediatric chronic wet cough; it was concluded that a two week course of amoxicillin clavulanate achieved cough resolution significantly. Research in Oregon has however proven that patients who received antibiotics in their initial visit for a respiratory tract infection were just as likely to return for follow-up visits as patients who did not receive antibiotics (Li et al., 2009).

Despite vast arguments against misuse of antibiotics, research has shown that the short-term benefits of using antibiotics for diagnoses for which antibiotics are not recommended outweigh the risks. The reason behind this is that, the immune system of the patient is weakened during an infection due to immune cells such as white blood cells fighting virus. The compromised immune system is vulnerable to attack by a second infectious agent which could be bacteria. The agent might even be previously harmless bacteria in the body whose ability to infect the human host was being controlled by the immune system and thus is now able to infect due to a weakened immune system. For prophylactic purposes, antibiotics are sometimes prescribed to patients without confirmed bacterial infections to prevent the patient from acquiring accompanying infections which would compound his or her problem. This is most evident in patients with HIV/AIDS who are likely to receive antibiotics for any infection.

Another reason why some prescribers prescribe antibiotics for respiratory tract infections without a confirmed bacterial cause is that; some infections when presented at the health facility are at the life-threatening stages where symptoms are very severe and there is inadequate time to carry out investigations for specific diagnosis without putting the patient's life at risk.

Most children with respiratory tract infections

Table 5. The statistical representation of data from Adabraka Polyclinic (out-patients).

Diagnosis No.	Specific (0/1)	STG recommended antibiotic (0/1)	Severity (0/1)	Other infection (0/1)	Antibiotics given (0/1)	Prescription matched STG			Criteria					
						None	Name	Dose/duration	I	II	III	IV	V	N/A
1	1	0	N/A	0	0	1			1					
2	1	0	N/A	0	0	1			1					
3	1	1	N/A	1	1		1	1	1					
4	0	N/A	N/A	0	1									1
5	1	0	N/A	1	1					1				
6	1	1	N/A	1	0								1	
7	1	0	N/A	1	1					1				
8	0	N/A	N/A	0	1									1
9	1	1	N/A	1	1		1	0				1		
10	1	1	N/A	1	0								1	
11	1	1	N/A	0	1		1	1	1					
12	1	1	N/A	0	1		0	0			1			
13	1	1	N/A	0	1		0	0			1			
14	1	0	N/A	1	1					1				
15	0	N/A	1	1	1									1
16	1	1	N/A	1	1		1	0				1		
17	0	N/A	N/A	1	1									1
18	1	1	N/A	1	1		0	0			1			
19	0	N/A	1	1	1									1
20	0	N/A	1	0	1									1
21	0	N/A	N/A	1	1									1
22	1	1	N/A	0	1		0	0			1			
23	1	1	N/A	0	1		0	0			1			
24	0	N/A	N/A	1	1									1
25	1	1	N/A	1	1		0	0			1			
26	0	N/A	N/A	0	1									1
27	1	1	N/A	1	1		0	0			1			
28	1	1	N/A	1	1		0	0			1			
29	1	1	N/A	1	1		0	0			1			
30	1	0	N/A	1	0	1			1					
31	1	1	N/A	1	1		0	0			1			
32	0	N/A	N/A	0	1									1
33	0	N/A	N/A	1	1									1
34	0	N/A	N/A	0	1									1
35	1	1	N/A	1	1		0	0			1			

Table 5. Cont`d.

36	1	1	N/A	1	1		0	0		1				
37	1	0	N/A	0	1	0						1		
38	0	N/A	N/A	0	0								1	
39	0	N/A	N/A	0	0								1	
40	1	1	N/A	0	1		1	1	1					

N/A: Not applicable.

Table 6. The summary of statistical data representing the criteria for appropriate use of antibiotics in both health facilities.

Health facility (in-patient/out-patient department)		Ridge Hospital (in-patient)	Percentage	Adabraka Polyclinic (out-patient)	Percentage
Total number of cases		40	100	40	100
Total number of cases where antibiotics were prescribed		27/40	67.50	33/40	82.5
Total number of specific diagnoses		27/40	67.50	26/40	65.00
Number of cases under criteria for appropriate use of antibiotics Deshmukh et al. (2015)	I	18	66.67	6	23.08
	II	1	3.70	3	11.54
	III	5	18.52	12	46.15
	IV	1	3.70	2	7.69
	V	2	7.41	3	11.54
Number of cases representing appropriate use of antibiotics		19/27	70.37	9/26	34.62
Number of cases representing inappropriate use of antibiotics		8/27	29.63	17/26	65.38

also present with other symptoms indicating other infections. From the study, other observed infections include eye infections, meningitis, diarrhea and skin infections. In such cases, the prescription of antibiotics to the patient cannot be attributed to the respiratory infection alone and thus even if the respiratory infection is found to be of a viral origin, antibiotics may still be prescribed for the non-respiratory infection. In addition the presence of other infections might be as a result of the respiratory infection spreading to other organs in the patient's body. In either case, the compounding infection means that the patient's immune system will be further compromised and thus prophylactic antibiotic therapy is necessary. Notwithstanding the reasons given above, setting boundaries for antibiotic use and advocating caution against its misuse is necessary. This is to deter prescribers from using the above reasons as a loophole to prescribe antibiotics to most, if not all cases of respiratory tract infection they encounter without specific diagnosis irrespective of the severity of the condition of the patient. The short term benefits of prescribing antibiotics must be weighed against long-term effects of antibiotic misuse on the child such as reduced exposure of the immune system to antigens which help to strengthen it against future attacks thus making him or her vulnerable to infections as he or she grows. Long-term effects on the community as a whole such as development of resistant microbial strains resulting in the antibiotic becoming, ineffective and costly need to produce

other antibiotics for the same infection. Generally prescribers must consider non-antibiotic treatments thoroughly before opting for antibiotics. To solve the problem of inadequacy of time for specific diagnosis, some modern advancement has been made. These include the use of rapid viral testing in the emergency department for pediatric patients. In 2013, researchers also developed a breath tester that can promptly diagnose lung infections (Zhu et al., 2013). Diagnostic uncertainty has been attributed as the major cause of irresponsible antibiotic prescribing (Kunin, 1973). The necessary rapid diagnostic tools should be made available in health facilities to influences specific diagnoses and the prescription of appropriate medication to patients with respiratory diseases. `In addition, modern diagnostic tools enable doctors to rapidly diagnose the cause of infection (Bjerrum et al., 2006). Lack of information is one of the major causes of irresponsible use of antibiotics (Hashemi et al., 2013), proper education should be given to both potential and practicing health officials on what constitutes appropriate antibiotic use, the need for this to be practiced and the available recommendations and guidelines for prescribing. They should also be educated on how not to succumb to demands from patients for antibiotics and the need to counsel patients to adhere to duration of antibiotic treatment.

Recommendations and guidelines for treatment of diseases including respiratory diseases should be updated frequently to ensure that prescribers have the most recent information concerning the diseases they treat and the medications indicated for them. As such, prescribers are fully aware of which antibiotics have become ineffective due to resistance development and the appropriate use of the indicated antibiotics for every diagnosis.

Conclusion

Responsible prescription of antibiotics for children with respiratory tract infections is practiced moreat Ridge Hospital than at Adabraka Polyclinic. It can also be inferred that, responsible prescription of antibiotics for children with respiratory tract infections is practiced more at the in-patient department of hospitals than at the out-patient department and as such the level of the health institution and the departmental structure influence the rate of responsible antibiotic prescribing. In addition, children are less likely to suffer from respiratory tract infections as they grow.

Limitation of the study

One limitation encountered in the study was that some patient cases were not specifically diagnosed. This resulted in an inability to determine if antibiotic treatment or lack thereof was appropriate or not since there was no basis for comparison. Also, some data required for the study were not available in the medical folders. These include dosages of some prescribed antibiotics and patient weights for calculating weight-based doses.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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