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Research Article

Overuse of Antibiotics in Children with Viral Upper Respiratory Tract Infection a Cross-Sectional Study

Eman Almerashi[1] and Lemis Yavuz[2]*

[1]*Mohammed Bin Rashid University of Medicine and Health Sciences, College of Medicine, Dubai, UAE*

[2]*Consultant Pediatrics, Al Jalila Children's Speciality Hospital, Dubai, UAE*

***Corresponding Author:** Lemis Yavuz, Consultant Pediatrics, Al Jalila Children's Speciality Hospital, Dubai, UAE.

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Abstract

Introduction: Viruses are the most common causes of upper respiratory tract infection URTI in children. No doubt antibiotics are being overused and became a major public health problem [1]. Consequences of misusing antibiotics are known, but limited studies were conducted in middle east to address this problem and to increase awareness about it.

Methods: A Cross-sectional study that overlooks the frequency of antibiotics prescribed to children with viral upper respiratory tract infection presenting to Al Jalila Children's Speciality Hospital AJCH in the United Arab Emirates from January 2017 to September 2018. Patient information such as demographics, symptoms, and lab test results (Nasal swab, throat swab, throat culture) was analysed and computed.

Results: 349 children presented to Al Jalila Children's Speciality Hospital in Dubai, UAE, with a viral infection confirmed by PCR swab. One hundred forty-four of them (41.3%) were given antibiotics and 205 (58.7%) were not given any antibiotics. Amoxicillin clavulanic acid had the highest rate of prescription (50.7%).

Conclusion: The overuse of antibiotics was much higher than expected. Preventive measures need to be taken by doctors prescribing antibiotics, and awareness needs to be brought to parent's attention about the appropriate use of antibiotics. Furthermore, additional research needs to be conducted to determine the causes of overusing antibiotics.

Keywords: *Overuse; Antibiotics; Children; Upper Respiratory Tract Infection*

Introduction

The overuse of antibiotics is a growing problem and needs a global effort to control its consequences. Alexander Fleming, who won a Nobel Prize in 1945 for his penicillin discovery, predicted that antibiotics misuse would lead to resistant bacteria. That leaves people susceptible to highly resistant bacterial infections, therefore prolonging their illness and increased death risk.

Scarce studies are looking into the UAE's position in this global trend. According to our knowledge, this research is the only study conducted in the UAE that highlights the extent of overuse of antibiotics in children, the correlation of antibiotics with viruses, and possible preventive measures that may be implemented.

Objectives of the Study

1. To determine the number of children less than four years of age presenting to Al Jalila Children's Speciality Hospital with signs and symptoms of viral upper respiratory tract infection and confirmed by PCR nasal swab.

2. To investigate the number of patients with viral upper respiratory tract infections prescribed with antibiotics from previous hospitals or Al Jalila Children's Speciality Hospital.

3. To compare the prevalence of antibiotic prescription in children with viral upper respiratory tract infection to children that were not prescribed antibiotics.

4. To highlight the necessity of increasing parents' awareness and implementing a stricter guideline for an antibiotic's prescription.

Methods

Study design and Setting

A cross-sectional study conducted to look at the prevalence of antibiotic prescription in children with viral URTI presenting to Al Jalila Children's Specialty Hospital Emergency Department in Dubai, UAE, between January 2017 and September 2018. Through the hospital's systems, all information that doctors imputed as well as laboratory results were reviewed. The sample was selected using simple random sampling.

Participants

Children under four years of age presenting to the Al Jalila Hospital emergency or clinic for viral URTI were selected. The viral swab PCR done for all. If viral nasal swab results came back positive, then their results were included as a viral infection. If laboratory tests for bacterial infection came back positive, they were excluded from the study. Any antibiotics prescribed from previous hospitals before presenting to AJCH regarding the same current viral infection were also recorded.

Variables

Demographic variables collected during the study were patient gender, nationality, and age (months). The date that the patient presented to the hospital and the symptoms that the patients presented with (coughing, running nose, and fever) were also collected. In order to confirm the virus as the causative agent of the infection, nasal swab (+ve/-ve), throat swab (+ve/-ve), and throat culture (+ve/-ve) results were reviewed as well as the virus type. And lastly, antibiotics (given/not given) and the antibiotic type was gathered.

Bias

In order to limit the unreliability, the collected sample size that was confirmed positive for viral infection was matched with the minimum calculated sample size that is required for a reliable study. So, the 86 additional data that is negative for both viral and bacterial lab results did not affect the study's reliability, thus limiting misclassification bias.

Ethical statement

Patients whose files were looked at are minors however, all data were anonymous and protected. No identifying patient information will be published. This research topic has been approved by the Mohammed Bin Rashid University-IRB committee (MBRU-IRB-SRP2018-036) and Al Jalila Children's Speciality Hospital.

Study size

Using the following equation: $N = \frac{Z^2_{\alpha/2} P(1-P)}{B^2} = 264$.

Using an online sample size calculator an article with population proportion of 22%, confidence level 95% and confidence interval of 5%, sample size was calculated to be 264.

Quantitative variables

The age and dates were the only two continuous variables in the study. To be able to use SPSS analysis to compare age (a continuous variable) to other qualitative factors, it had to be converted into qualitative categories. Therefore, age was categorized into three different groups: 1 to 9 months of age, 10 to 19 months and lastly, ages greater than 20 months. This classification was determined by conducting a frequency table and dividing it based on each category's distribution of data. The presenting dates were sorted in order on Microsoft Excel, and a frequency table was conducted to see which months the incidence of viral infection occurred the most. The results were then plotted on a line graph (Figure 1).

Statistical methods

Data was imputed onto a google forms sheet then converted to Microsoft Excel and SPSS for analysis. A frequency table was conducted on the binary data: Gender, Nationality, Age, Symptoms, Antibiotics (+ type), and Virus type. Cross tabulations and Chi-Square was used to determine the type of association between binary variables, and Exact Fisher test was used to test the significance. An alpha value of $p \leq 0.05$ was chosen to determine statistical significance. For continuous variables, one sample T-test was used to test the differences in the means of the sample in comparison to other published literature. There was no missing data.

Results

Participants

The data consists of a total of 349 children four years old and younger who have presented to Al Jalila Children's Hospital with viral infection diagnosed by laboratory nasal swab, throat swab and throat culture results.

Variables	All	P-value	Male	Female
Gender-n (%)	349		202 (57.9)	147 (42.1)
Age categories- n (%)				
1 - 9 months	77 (22.1)	0.001*	59 (76.6)	18 (23.4)
10 - 19 months	126 (36.1)	0.001*	68 (53.9)	58 (46)
> 20 months	146 (41.8)	0.001*	75 (51.3)	71 (48.6)
Nationality- n (%)				

UAE	333 (95.4)	0.444	191 (57.3)	142 (42.6)
Others	16 (4.6)	0.444	11 (68.7)	5 (31.2)
Symptoms- n (%)				
Cough	284 (81.4)	0.332	168 (59.1)	116 (40.8)
Fever	318 (91.1)	1	184 (57.8)	134 (42.1)
Runny Nose	194 (55.6)	0.663	110 (56.7)	84 (43.2)
Vomiting	28 (8)	0.233	13 (46.4)	15 (53.5)
Difficulty Breathing	12 (3.4)	1	7 (58.3)	5 (41.6)
Rash	7 (2)	1	4 (57.1)	3 (42.8)
Decreased Oral Intake	5 (1.4)	0.166	1 (20)	4 (80)
Viral Types -n (%)				
Respiratory Syncytial Virus	88 (25.2)	0.62	53 (60.2)	35 (39.8)
Influenza A	86 (24.6)	0.132	56 (65.1)	30 (34.9)
Adenovirus	38 (10.9)	0.731	21 (55.3)	17 (44.7)
Human Metapneumovirus	16 (4.6)	0.017	14 (87.5)	2 (12.5)
Influenza B	17 (4.9)	1	10 (58.8)	7 (41.1)
Parainfluenza	10 (2.9)	0.332	4 (40)	6 (60)
Coronavirus	7 (2)	0.045*	1 (14.3)	6 (85.7)
Human Boca virus	1 (0.3)	1	1 (100)	0 (0)
Antibiotics- n (%)				
Not-given	205 (58.7)	0.931	84 (40.9)	60 (29.2)
Given	144 (41.3)	0.931	118 (81.9)	87 (60.4)

Table 1: *Descriptive data of Pediatrics with Viral URTI presenting to Al Jalila Children's Hospital, Dubai, United Arab Emirates, 2017 - 2018.*

Variables are presented as total (n) and percentage (%).

**: Denotes significant P-value. P-value of ≤ 5 was considered for statistical significance. Chi and Fisher Exact test was used to find P-value.*

URTI: Upper Respiratory Tract Infection.

Descriptive data

349 patient's data were collected, more of which are males (57.9%) than females (42.1%) (Table 1). The majority (41.8%) of the paediatrics presented to Al Jalila were older than 20 months. 95.4% of the children were UAE nationals. The main presenting symptoms of 91.1% of them was fever, 81.4% had a cough, and runny nose was seen in 55.6%. The most common virus type was Respiratory Syncytial Virus (RSV) (25.2%), the second most common being Influenza A virus (24.6%) (Table 1).

Of the overall viral infections, the incidence was highest during the winter season (October, November, December, January, and February). The peak month was November, with a prevalence of 130 (37.2%) viral cases (Figure 1). The antibiotic rate of prescription also peaked during November (12.6%) (Figure 1).

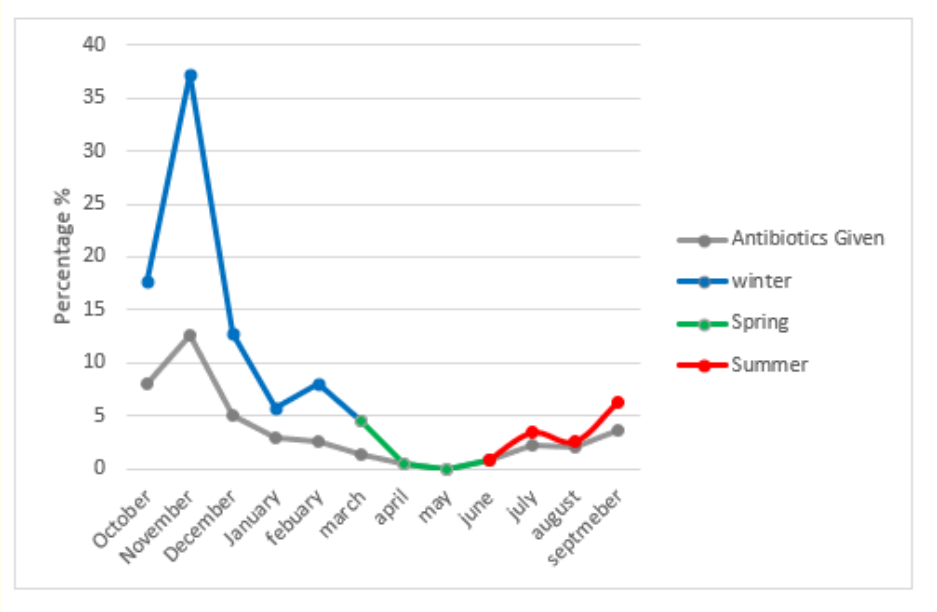

Figure 1: *Virus peak incidences during seasonal changes by month of children in Al Jalila Children's Speciality Hospital, Dubai, United Arab Emirates, 2017 - 2018.*

Main results

Our study showed that out of 349 patients with a viral infection, 41.3% (144) were given antibiotics, and 58.7% (205) were not given any antibiotics. With Amoxicillin clavulanic acid being the highest rate of prescription (50.7%) and Azithromycin being the second highest (23.6%) (Figure 2). Using the Fisher-exact test there was a negative association between fever and antibiotics given with a significance level of (0.02). With a significance level of (0.04), there was a negative association between coronavirus and antibiotics given. With a significance level of (0.01), there was positive association between the patient's age and antibiotics given. Influenza A (24.64%) and RSV (25.2%) were the highest prevalence of viruses amongst the children. RSV was seen most in children below 20 months (sig value of 0.00). Influenza A was mostly prevalent in paediatrics more than 20 months of age (sig value of 0.00).

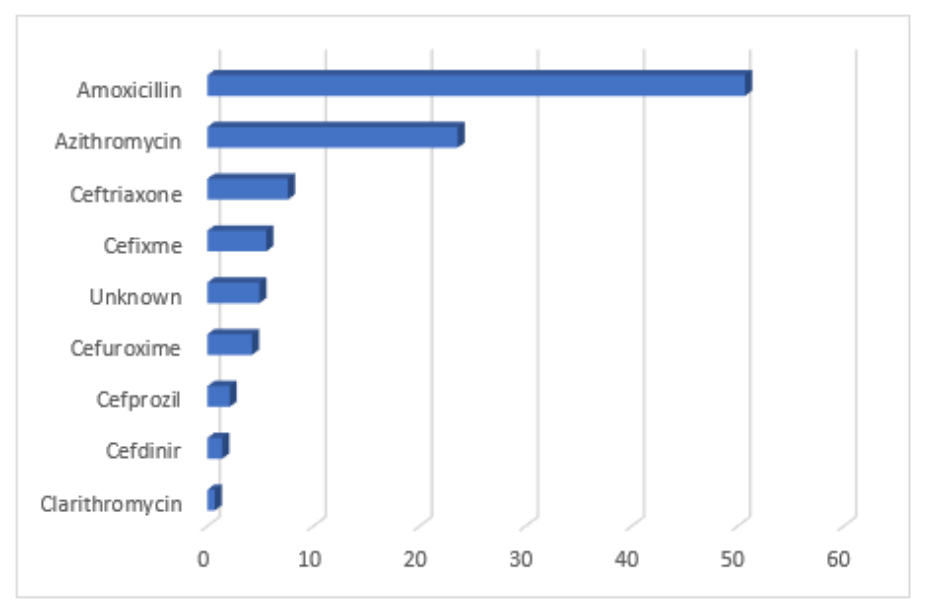

Figure 2: *Antibiotic type prescribed to children with viral upper respiratory tract infection presented to Al Jalila Children's Hospital, Dubai, United Arab Emirates, 2017 - 2018.*

Discussion

Summary of major findings and comparing to other studies

The results of our study show that in a total of 349 paediatrics with viral infections, 41.3% (144) were given antibiotics, and 58.7% (205) were not given any antibiotics. So, there was a very high unnecessary prescription of antibiotics, much more than expected. Comparing this to the USA, the Centre of Disease Control and Prevention (CDC) website states that in the USA doctor's offices and emergency departments, at least 30% of annual antibiotic prescriptions were unnecessary and of the 70% necessary prescription there still needs to be an improvement on dosing duration and drug selection [2].

Our study found that the antibiotic Amoxicillin clavulanic acid was prescribed the most in all the children (50.7%) (Figure 2). Coming in second to Amoxicillin clavulanic acid was Azithromycin with a 23.6% prescription rate of total antibiotics prescribed to viral URTI paediatrics (Figure 2).

Our results displayed a positive association between patients' age and antibiotics were given. Indicating that antibiotics were prescribed to children over 20 months (n = 67, 19.2%) more than in children between 10 – 19 months (n = 60, 17.2%) and more than infants that are younger than 10 months (n = 17, 4.9%). While in Bangladesh and Pakistan, it was recorded that 98% of infants presenting to the hospital have received antibiotics by 6 months of age [3].

Influenza A (24.64%) and RSV (25.2%) were the highest prevalence of viruses amongst the children in our study. In particular, RSV was seen most in infants 1 - 9 months and 10 - 19 months old. At the same time, Influenza A was seen most commonly in children more than 20 months old. However, no significant association was found between RSV and Influenza A viruses with an antibiotic prescription.

Other significant findings

As expected, viruses peaked during the winter months compared to any other months (Figure 1). Hence winter is commonly known as the "common cold" season. 37% of all the viral cases occurred during November, where there is a sudden rise in incidence. This could be due to the fact that viruses cause the common cold to spread more easily during dry cold weather. Moreover, during the summer months, there was a decline in incidences. This could be due to the fact that most families are travelled during the summer holidays (Figure 1). As expected, with the peak in viral infection, there was a mirrored peak in antibiotics prescription (12.6%) (Figure 1).

Implications for public health practitioners/clinicians/educators

This research gives an insight into the UAE's position in the antibiotic prescription crisis occurring worldwide, so we now know where we stand in this global phenomenon. This study looks at associated symptoms of each virus type as well as other variables in each patient and relates it to antibiotic prescription. With this information, hospitals can find ways to reduce antibiotics prescriptions by doctors with closer monitoring and stricter guidelines on antibiotics prescription implications. Besides, parents and even the general population should be educated on the inappropriate use of antibiotics and its consequences. Moreover, this research will provide a good basis for further research and expansion.

Strengths, Limitations and Generalizability

This study's strength is that there is scarce research worldwide that looks at the prevalence of antibiotics with viral infections, so this research is one of the few. There are even fewer studies, almost none, here in the UAE that looks at this phenomenon. No statistics exist in the UAE that shows the number of antibiotics prescribed and the type, so this study is the first. This study's limitations are that follow-up sessions of patients (if present) will not be looked at on whether or not the patient was compliant or the doctor readjusted the antibiotics in the subsequent consultation. This research is also looking at patients presenting to a tertiary hospital in Dubai or coming from other hospitals in Dubai, so is not representative of the whole UAE population.

Areas for Future Research

Questionnaires could be given to mothers to view their knowledge on this subject matter and whether they understand the indications for an antibiotic prescription and assess their understanding of the antibiotic-resistant crisis. This will help in understanding which aspect will be more effective in reducing the antibiotic prescription. Future research could also follow the child to see how he/she copes with bacterial infection and antibiotic use in the future years. The research could be conducted in different cities across the UAE to compare means and view parents' degree of awareness across the cities.

Suggestive preventative measures

Three key factors play a role in antibiotic resistance, the doctors prescribing the medication, the child's parents who are giving it to him/her, and then the antibiotic-resistant patients that are spreading the infection. Hence this issue can be tackled from either of those three aspects. By appointing Antibiotic Stewardship Programs, the doctors will have stricter guidelines and closer monitoring by the hospitals to administer antibiotics. Besides, parents must be more aware of antibiotics' indications and the consequence of prescribing it out of its indication, this falls under community education. This awareness can be brought to both mother's and father's attention by playing a simple short video in the waiting room or handing out leaflets with brief, accessible explanations of the concept of a viral infection versus a bacterial infection.

Conclusion

In conclusion, antibiotic prescription rates in children with viral infection were much higher than expected. This research is the first of its kind in the United Arab Emirates (UAE). With this research, the extent of overuse was highlighted and solutions to tackle this crisis were explained. Additional research needs to be conducted in different hospitals to distinguish the extent of unnecessary antibiotics prescriptions across the UAE. By addressing this crucial problem, a major steps and instruction should be taken to control the use of antibiotics.

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