

## Antibiotic Prescribing Trends in an Omani Paediatric Population

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### اتجاهات وصف المضادات الحيوية في عينة من الأطفال العمانيين

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**ABSTRACT: Objectives:** This study aimed to evaluate antibiotic prescribing patterns for paediatric patients at Sultan Qaboos University Hospital (SQUH), a tertiary care hospital in Muscat, Oman. **Methods:** This retrospective cross-sectional study included all 1,186 prescriptions issued for 499 patients at the paediatric outpatient clinic and paediatric inpatient ward at SQUH between March and May 2012. **Results:** Of the 499 patients, 138 (27.6%) were prescribed a total of 28 different antibiotics. A total of 185 (15.6%) antibiotic prescriptions were issued among the total drug prescriptions. Preschool children aged 0–6 years were prescribed antibiotics most frequently (n = 110). Co-amoxiclav was the most commonly prescribed antibiotic in both inpatients and outpatients (27.0% and 33.9%, respectively), followed by cefuroxime in inpatients (13.5%) and azithromycin in outpatients (18.6%). Co-amoxiclav was the most commonly prescribed antibiotic in both 0–6 (31.3%) and 7–11 (23.3%) year-olds, while cefuroxime was most commonly prescribed in children ≥12 years old (25.0%). **Conclusion:** Antibiotic prescription patterns in this population were similar to those in North America, Europe and Asia. To confirm the findings of this study, further research on antibiotic prescription trends across the wider paediatric population of Oman should be initiated.

**Keywords:** Antibiotics; Pediatrics; Drug Prescription, trends; Oman.

**المخلص: الهدف:** هدفت هذه الدراسة إلى تقييم أنماط وصف المضادات الحيوية للأطفال المرضى في مستشفى جامعة السلطان قابوس (مستشفى مرجعي في مسقط، سلطنة عمان). **الطريقة:** شملت هذه الدراسة الاستيعابية المستعرضة جميع الوصفات (1,186) الصادرة لـ 499 مريضاً في العيادة الخارجية للأطفال والأطفال المنومين في المستشفى بين مارس ومايو 2012 النتائج: تم وصف ما مجموعه 28 مضاداً حيويًا لـ 138 (27.6%) مريضاً وصدر ما مجموعه 185 (15.6%) وصفات المضادات الحيوية بين إجمالي الوصفات الطبية للأدوية. تم وصف المضادات الحيوية بشكل أكبر في الأطفال قبل سن المدرسة الذين تتراوح أعمارهم بين 0–6 سنوات (n = 110). كان وصف عقار الأموكسيسيكلاف هو الأكثر شيوعاً في كل من المرضى المنومين ومرضى العيادات الخارجية (27.0% و 33.9% على التوالي، يليه عقار السفيوركسيم في المرضى المنومين بالمستشفى (13.5%) و عقار الأزيثروميسين في مرضى العيادات الخارجية (18.6%). كان وصف عقار الأموكسيسيكلاف هو الأكثر شيوعاً في الأطفال الذين تتراوح أعمارهم بين 0–6 سنوات (31.3%) و 7–11 سنوات (23.3%)، في حين كان السفيوركسيم الأكثر شيوعاً في الأطفال ≥12 سنة (25.0%). **الخلاصة:** كانت أنماط وصف المضادات لهذه الفئة العمرية مماثلة لتلك المرصودة في أمريكا الشمالية وأوروبا وآسيا. ولتأكيد نتائج هذه الدراسة، ينبغي الشروع في إجراء المزيد من البحوث بشأن اتجاهات وصف المضادات الحيوية في عينة تشمل عدداً أكبر من الأطفال في سلطنة عمان.

**مفتاح الكلمات:** المضادات الحيوية؛ الأطفال؛ وصف الأدوية؛ الاتجاهات؛ عمان.

#### ADVANCES IN KNOWLEDGE

- This study investigates antibiotic prescription trends in a paediatric population in Oman.
- The results of this study found that children aged 0–6 years old were prescribed antibiotics most frequently.

#### APPLICATION TO PATIENT CARE

- The results of this study highlight the need for hospitals to follow more guideline-based antibiotic prescription practices.
- Furthermore, hospitals should implement uniform antibiotic prescription policies based on national antibiotic sensitivity patterns.

ANTIBIOTICS ARE ONE OF THE MOST commonly prescribed type of drugs in the world. Studies indicate that approximately one-third of all hospitalised patients receive antimicrobial therapy.<sup>1</sup> A study from 1999 to 2005 in the Netherlands found that antibiotics were the most commonly prescribed medications among children.<sup>2</sup>

They are primarily administered for acute respiratory illnesses, with 70% of all prescriptions issued for upper respiratory tract infections in paediatric patients.<sup>3,4</sup> A study performed in Norway found that preschool children were the group most commonly exposed to antibiotics.<sup>5</sup>

Antibiotics are often prescribed for children,

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especially in primary care settings, without there being any likely therapeutic effects; this practice was noted among a group of children in British Columbia, Canada.<sup>6</sup> The increase in antibiotic prescriptions, accompanied by their inappropriate use, augments the rates of antibiotic resistance and the burden on healthcare budgets worldwide.<sup>7,8</sup> Antibiotic resistance can lead to prolonged hospitalisation, failed treatments, increased healthcare costs and mortality.<sup>9</sup>

To ensure the appropriate use of antibiotics, several factors need to be addressed concerning the individual microorganism, patient, disease and drug.<sup>9</sup> The Centers for Disease Control and Prevention in the USA define appropriate antibiotic prescription practices as “prescribing antibiotics only when they are likely to be beneficial to the patient, selecting agents that will target the likely pathogens and using these agents at the correct dose and for the proper duration”.<sup>10</sup> Moreover, the World Health Organization (WHO) defines appropriate use as “the cost-effective use of antimicrobials which maximises clinical therapeutic effect while minimising both drug-related toxicity and the development of antimicrobial resistance”.<sup>11</sup>

There are many reasons behind the misuse of antibiotics. These include misdiagnoses due to human error, technical reasons and factors related to pharmaceutical industry promotion.<sup>12</sup> Many hospitals have attempted to deal with the issue of antibiotic misuse by creating guidelines and restricting the use of certain antibiotics in order to reduce the emergence of drug-resistant bacterial strains and increase the life span of these medications. It is therefore essential to apply a rationalisation and evaluation policy to the prescription of anti-infectious drugs in healthcare facilities.<sup>13</sup>

Research to date has focused on adult populations with a limited emphasis on the antibiotic prescribing trends for paediatric patients.<sup>14</sup> To the best of the authors’ knowledge, there are few local data from Oman on drug prescription trends in the paediatric population.<sup>15</sup> In consequence, this study aimed to understand antibiotic prescribing patterns for paediatric patients at Sultan Qaboos University Hospital (SQUH), a tertiary hospital in Muscat, Oman.

## Methods

In this retrospective cross-sectional study, patients’ electronic record data from the period of March to May 2012 were analysed. All paediatric patients who visited SQUH during the catchment period were included in the study. Records were included from both the outpatient paediatric clinics and inpatient paediatric wards at the hospital. A total of 1,186 prescriptions for

**Table 1:** Patient demographic characteristics (N = 499)

Characteristic	n (%)
<b>Age in years</b>	
0–6	329 (65.9)
7–11	117 (23.4)
≥12	53 (10.6)
Mean ± SD	5.0 ± 4.4
<b>Gender</b>	
Male	285 (56.9)
Female	214 (42.9)
Weight in kg, mean ± SD	18.5 ± 15.1
<b>Patient status</b>	
Inpatient	178 (35.7)
Outpatient	321 (64.3)
<b>Treatment duration in days, median (IQR)</b>	<b>7.0 (0.0–30.0)</b>

SD = standard deviation; IQR = interquartile range.

499 patients were analysed.

Descriptive statistics were used to describe the data. For categorical variables, frequencies and percentages were reported. For continuous variables, the mean and standard deviation (or median and interquartile range, wherever appropriate) were used to summarise the data. The Statistical Package for the Social Sciences (SPSS), Version 19.0 (IBM Corp., Chicago, Illinois, USA) was used to analyse the data.

This study was approved by the Medical Research & Ethics Committee of the Sultan Qaboos University College of Medicine & Health Sciences (MREC#567).

## Results

A total of 1,186 prescriptions for 499 patients were analysed. The mean age was 5.0 ± 4.4 years. The most frequently encountered age group was children aged 0–6 years (n = 329), with males representing 56.9% of all patients. Most of the children were outpatients (64.3%) visiting the paediatric outpatient clinic at SQUH. The median treatment duration was seven days [Table 1]. Among the children who were prescribed antibiotics, the most common diseases were respiratory diseases (n = 62; 44.9%) followed by haematological conditions (n = 18; 13.0%) and gastrointestinal diseases (n = 8; 5.8%).

Of the 499 patients, 138 (27.6%) were prescribed a total of 28 different antibiotics. The number of antibiotic prescriptions was similar between genders (70 and 68 for males and females, respectively). There was a trend towards more antibiotic prescriptions

**Table 2:** The most commonly prescribed antibiotics in inpatients and outpatients by age group (N = 185 antibiotics)\*

Antibiotics prescribed												
n (%)												
Age group											Total	
0–6 years			7–11 years			≥12 years						
All	IP	OP	All	IP	OP	All	IP	OP	All	IP	OP	
AMC: 46 (31.3)	AMC: 33 (29.7)	AMC: 13 (36.1)	AMC: 7 (23.3)	AZT: 3 (30.0)	AMC: 6 (30.0)	CFM: 2 (25.0)	CFM: 1 (33.3)	AZT: 1 (20.0)	AMC: 54 (29.2)	AMC: 34 (27.0)	AMC: 20 (33.9)	
AZT: 16 (10.9)	CFM: 14 (12.6)	PMP: 9 (25.0)	AZT: 7 (23.3)	CFM: 2 (20.0)	AZT: 4 (20.0)	CEF: 2 (25.0)	CEF: 1 (33.3)	AMC: 1 (20.0)	AZT: 23 (12.4)	CFM: 17 (13.5)	AZT: 11 (18.6)	
CFM: 15 (10.2)	AZT: 10 (9.0)	AZT: 6 (16.7)	CEF: 5 (16.7)	CEF: 2 (20.0)	CEF: 3 (15.0)	AZT: 1 (12.5)	TET: 1 (33.3)	CEF: 1 (20.0)	CFM: 20 (10.8)	CEF: 16 (12.7)	PMP: 10 (16.9)	
PMP: 11 (7.5)	CTX: 10 (9.0)	CEF: 2 (5.6)	CFM: 3 (10.0)	AMC: 1 (10.0)	VAN: 2 (10.0)	AMC: 1 (12.5)	-	CTX: 1 (20.0)	CEF: 16 (8.6)	AZT: 12 (9.5)	AMO: 4 (6.8)	
CTX: 10 (6.5)	CEF: 7 (6.3)	AMO: 1 (2.8)	VAN: 2 (6.7)	TOB: 1 (10.0)	PMP: 1 (5.0)	-	-	MUP: 1 (20.0)	PMP: 12 (6.5)	CTX: 10 (7.9)	CFM: 3 (5.1)	
-	-	-	-	-	CIPX: 1 (5.0)	-	-	-	-	-	-	
<b>Total</b>	<b>147</b>	<b>111</b>	<b>36</b>	<b>30</b>	<b>10</b>	<b>20</b>	<b>8</b>	<b>3</b>	<b>5</b>	<b>185</b>	<b>126</b>	<b>59</b>

IP = inpatients; OP = outpatients; AMC = co-amoxiclav; AZT = azithromycin; CFM = cefuroxime; CEF = ceftriaxone; PMP = phenoxymethylpenicillin; TET = tetracycline; AMO = amoxicillin; CTX = cefotaxime; VAN = vancomycin; TOB = tobramycin; MUP = mupirocin; CIPX = ciprofloxacin.

among inpatients compared to outpatients (80 versus 58 patients). Preschool children between 0–6 years old received antibiotics most frequently (n = 110; 79.7%) followed by 7–11 and ≥12-year-olds (n = 22; 15.9% and n = 6; 4.3%, respectively). Among the total drug prescriptions, antibiotics were prescribed in 185 cases (15.6%).

Co-amoxiclav was the most commonly prescribed antibiotic in both inpatients and outpatients (27.0% and 33.9%, respectively), followed by cefuroxime in inpatients (13.5%) and azithromycin in outpatients (18.6%) [Table 2]. Co-amoxiclav was the most commonly prescribed antibiotic in both 0–6 (31.3%) and 7–11-year-olds (23.3%), while cephalosporins were the most commonly prescribed antibiotic in the ≥12-year-old age group (50%) [Table 2]. In the 0–6-year-old age group, co-amoxiclav was the leading antibiotic prescribed for both inpatients and outpatients (29.7% and 36.1%, respectively). This was followed by cefuroxime among the inpatients (12.6%) and phenoxymethylpenicillin among the outpatients (25.0%). In the 7–11-year-old age group, co-amoxiclav was the most commonly prescribed antibiotic among outpatients (30.0%) while azithromycin was the

predominant antibiotic prescribed among inpatients (30.0%).

## Discussion

The aim of this study was to describe the antibiotic prescribing patterns among paediatric patient prescriptions at SQUH. In this study, 27.6% of the patients were prescribed a total of 28 different antibiotics. This is similar to the results of a large cohort study in three European countries which showed an antibiotic prescription rate of 30%.<sup>16</sup> A review of antibiotic prescribing trends in paediatric outpatients noted a prescription rate ranging from 14.2% in the UK to 52.4% in Canada.<sup>17</sup> In addition, a study of WHO core drug-prescribing indicators in an Indian neonatology unit showed that 30.2% of the patients were prescribed antibiotics.<sup>18</sup> In a study performed in Nepal, antibiotics were shown to be the most commonly prescribed drug (23%; n = 1,614 drugs in 356 patients) while ampicillin was the most commonly prescribed drug in paediatric wards.<sup>19</sup> A Pakistani study of 2,433 prescriptions in children under five years of age showed that antibacterials

were prescribed in 49% of encounters and ampicillin and cotrimoxazole were the two most commonly prescribed antibacterials.<sup>20</sup> It is difficult to draw firm conclusions by comparing the results of the current study to those cited above, as each study had a different design and populations with differing morbidity profiles and socioeconomic statuses.

The current study had some limitations. First, it should be noted that antibiotic prescribing patterns vary between winter and summer.<sup>21</sup> The current study's data were recorded during the period of March to May, which is a transitional period between summer and winter. It is possible that the pattern of antibiotic prescriptions may differ during other seasons of the year. Furthermore, specific prescribing details such as indications and dosage frequency were not recorded in this study. In addition, as the study was performed in a single institution, the results may not be generalisable to the whole population of Oman.

The choice of agents prescribed in the study was similar to those observed in other European and Asian countries.<sup>19,20,22</sup> However, the percentage of children prescribed each antibiotic as a first choice varies between countries. Co-amoxiclav was the most commonly prescribed antibiotic (29.2%) in the study for both inpatients and outpatients (27.0% and 33.9%, respectively). The comparison between these data and data from other countries may reflect true clinical differences, along with other factors such as prescribing attitudes among physicians, economic determinants, pharmaceutical industry promotion and sociocultural factors. However, this comparison should take into account heterogeneity between studies.

Antibiotic misuse among paediatric patients is a major public health concern as infections are the most frequent cause of childhood diseases and systemic antibiotics account for one-third of all prescriptions in preschool children.<sup>23</sup> Young patients and children admitted to intensive care units are particularly at risk of receiving multiple courses of antibiotics.<sup>24</sup> As antibiotic resistance develops in this setting, strategies to control antibiotic use should focus on these patient populations.<sup>24</sup> Several professional societies have issued guidelines designed to optimise the use of antibiotics worldwide by means of various control strategies.<sup>1,10-12,24</sup>

## Conclusion

This study highlights the trends of antibiotic use among an important patient population in Oman. Antibiotic prescribing patterns in Oman are similar to those in North America, Europe and Asia; however, the findings of this study should be interpreted in light

of its limitations. With the emergence of antibiotic resistance and rising healthcare costs, hospitals should encourage more guideline-based antibiotic prescription practices and implement a uniform antibiotic prescribing policy based on local sensitivity patterns.

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