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Title: Antibiotic Prescription Patterns for Upper Respiratory Tract Infections in Outpatient Qatari Population in the Private Sector

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- 1 Highlights
- 2 All outpatient antibiotics prescriptions for Qatari national were reviewed
- 3 Nearly 45% of prescribed antibiotics were deemed inappropriate based on the associated diagnosis
- 4 Highest proportion of inappropriate use was for upper respiratory infections
- 5

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5 Antibiotic Prescription Patterns for Upper Respiratory Tract Infections  
6 in Outpatient Qatari Population in the Private Sector

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49

50 Abstract

51 Background: Antibiotic are often inappropriately prescribed for upper respiratory infections (URI) in the  
52 Western countries. Data on the proportion of inappropriate prescriptions are lacking from the Middle  
53 East and other developing countries.

54 Methods: We retrieved health insurance claims for all antibiotics prescribed for URIs in the private  
55 sector in the State of Qatar between May 2014 and December 2015. During the study period, health

56 insurance was limited to Qatari nationals. We excluded topical antibiotics. We also retrieved data on  
57 prescriber's specialty as listed with the licensing authority. Diagnoses were classified as appropriate or  
58 inappropriate based on the likelihood of a bacterial etiology which may warrant antibiotic use.

59 Results: There were a total of 75,733 claims during the study period. Of these, 41,556 (55%) were for an  
60 appropriate indication, while 34,177 (45%) were for an inappropriate indication. Most common  
61 antibiotic classes were cephalosporins (43% of claims; 44% inappropriate), penicillins (28% of claims;  
62 44% inappropriate), macrolides (19% of claims; 52% inappropriate) and fluoroquinolone (9% of claims;  
63 40% inappropriate). Nearly 5% of antibiotics were intravenous formulations. The most common  
64 prescribers were General/Family physicians (53% of claims; 50% inappropriate), followed by Pediatrics  
65 (18.6% of claims; 36% inappropriate) and Internal Medicine (14.1 of claims; 44% inappropriate).

66 Conclusions: There is a high rate of inappropriate antibiotic prescription for acute URIs in the private  
67 health care sector in the State of Qatar. Further studies are needed to determine the population based  
68 rates across the country. Interventions to decrease inappropriate use in such settings are urgently  
69 needed.

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71 Key words: Antibiotics; inappropriate; upper respiratory tract;

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73 Inappropriate antibiotic use is associated with increasing antibiotic resistance, healthcare costs, adverse  
74 events and poorer outcomes. The global magnitude of inappropriate antibiotics prescription is not well  
75 defined. In a recent study from the US, nearly one-third of the antibiotics prescribed in the outpatient  
76 setting were deemed to be inappropriate.<sup>1</sup> Upper respiratory tract infections are the most frequent  
77 diagnoses associated with antibiotics prescription in the outpatient setting, accounting for nearly half of  
78 such prescriptions.<sup>2</sup> Between 30-64% of the antibiotics prescribed for upper respiratory tract infections  
79 are considered to be inappropriate.<sup>1,3-6</sup> There are variations in the rates of inappropriate antibiotics  
80 prescriptions, with much lower rates reported from some European countries compared to the US.<sup>7</sup>  
81 Factors associated with inappropriate antibiotic prescription include care setting (private vs. public  
82 hospitals),<sup>2</sup> patient characteristics (age, female gender, non-White race/ethnicity, education status,  
83 smoking),<sup>3,5,8</sup> socioeconomic factors (insurance status),<sup>3</sup> and provider factors (provider specialty).<sup>3</sup>  
84 Higher rates of inappropriate prescription have been linked with higher antimicrobial resistance rates.<sup>9</sup>

85

86 The rates and patterns of antibiotic use in the outpatient setting in the Middle Eastern and Gulf  
87 Cooperation Council (GCC) countries are unknown. Previous studies have shown high levels of  
88 antimicrobial resistance in the GCC countries, but the link to antibiotic prescription patterns has not  
89 been established. Qatar is a member of the six nation GCC (others being Kingdom of Saudi Arabia,  
90 United Arab Emirates, Bahrain, Kuwait and Sultanate of Oman). Qatar introduced a health insurance  
91 scheme for Qatari nationals in 2014 under which all claims were submitted to the National Health  
92 Insurance Company for payment. The health insurance scheme was planned to be eventually scaled up  
93 to the entire population of Qatar, both Qatari nationals and the expatriate population. We conducted  
94 this study to determine the rate of inappropriate antibiotic prescription in the outpatient private sector  
95 for upper respiratory tract infections.

96

96

97 Methods

98 We retrieved deidentified health insurance claims information for upper respiratory tract infections

99 submitted to the National Health Insurance Company (NHIC) for reimbursement between May 2014 and

100 December 2015. The NHIC receives claims from clinical providers across Qatar for Qatari nationals.

101 Diagnoses are based on International Classification for Diseases, 10<sup>th</sup> edition, Australian modification

102 (ICD10-AM). We selected claims associated with common upper respiratory infections diagnoses, using a

103 modified list adapted from Fleming-Dutra et al, for common respiratory conditions.<sup>1</sup> We divided the

104 diagnoses into two categories; 1) those for which antibiotics are generally indicated (appropriate

105 prescriptions), and 2) those for which antibiotics are generally not indicated (inappropriate

106 prescriptions). The former included diagnoses most likely to have a bacterial etiology and the latter

107 included those diagnoses most likely to have a viral etiology. Since there are no national guidelines for

108 use of antibiotics in such settings in Qatar, we used expert opinion of infectious diseases specialists to

109 categorize diagnoses into appropriate and inappropriate based on best published evidence. It is quite

110 possible that there may be an overlap in some categories, and other categories may have varied

111 etiology. In conditions where bacterial and viral etiologies were equally likely, or a preponderance of

112 evidence did not clearly identify the etiology to be viral, we erred on the side of conservatism in labelling

113 antibiotic use as appropriate for such conditions. We then retrieved all antibiotic prescriptions

114 submitted with those claims. Claims for medications prescribed are submitted along with primary

115 diagnoses associated with the claim. We excluded claims for topical antibiotics. The claims were

116 restricted to providers in the private sector and to Qatari nationals due to the gradual phasing-in

117 approach of the national health insurance plan.

118

119 We tabulated antibiotics prescription by condition and by age category. We also tabulated prescription

120 by specialty/subspecialty of the prescriber as recorded with the regulatory authorities in Qatar

121 (Supreme Council of Health at the time of study), and calculated the proportion of claims that were  
122 rejected by specialty/subspecialty. We also tabulated number of claims by individual antibiotic and  
123 antibiotic class and the proportion of claims rejected for each antibiotic and antibiotic class. Finally, we  
124 plotted antibiotics claims per month for the study period to demonstrate the seasonal variation in  
125 antibiotic prescription.

126

127 Since all data retrieved were deidentified and there was no contact with the participants, we sought a  
128 waiver of informed consent from the Institutional Review Board at Hamad Medical Corporation, which  
129 approved the study.

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132 Results

133 Between May 2014 and December 2015, there were 75,733 claims for non-topical antibiotics that were  
134 prescribed for acute upper respiratory tract infections. (Table 1) The breakdown of claims by diagnosis  
135 and age categories is provided in table 1. Overall, 45% of the antibiotics were deemed inappropriate  
136 based on the accompanying diagnosis. There was a trend towards increasing inappropriate use with  
137 increasing age groups (42% for age group 0-17 years; 47% for 18-65 years; 54% for >65 years). The  
138 diagnoses most commonly associated with inappropriate antibiotic prescription were acute upper  
139 respiratory tract infections, including viral upper respiratory infections (28,898 claims; 85% of  
140 inappropriate prescription). The largest number of prescriptions were by General/Family Practice  
141 physicians, accounting for 52.7% of the prescriptions (50% inappropriate), followed by Pediatrics (18.6%  
142 of prescriptions; 36% inappropriate) and Internal Medicine (14.1 of prescriptions; 44% inappropriate).  
143 Emergency Medicine physicians accounted for only 2% of the prescriptions, but the highest number of  
144 inappropriate prescriptions (74%) among those with >1,000 claims. (Table 2)



145  
146 Cephalosporins were the most commonly prescribed group of antibiotics (43% of all claims), followed by  
147 penicillins (including combination with enzyme inhibitors, e.g. amoxicillin-clavulanate, 28%), macrolides  
148 (19%) and fluoroquinolones (9%). (Table 3) Nearly 5% of all claims were for intravenous antibiotics.  
149 (Table 4) Although data are not available for two complete years, there were less claims for antibiotics  
150 in the peak summer months (June-September) compared with rest of the year. (Figure 1)

151  
152 A detailed list of all antibiotics prescribed and proportion of inappropriate prescriptions for each  
153 antibiotic are presented in supplementary table 1. A detailed list of each antibiotic class and associated  
154 diagnoses for which they were prescribed are presented in supplementary table 2.

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157 Discussion:

158 In this study of outpatient Qatari population in the private sector, we found that 45% of the patients  
159 who were prescribed antibiotics for upper respiratory tract infections were for an inappropriate  
160 indication. The largest number of prescriptions were from General/Family Practice physicians, followed  
161 by Pediatrics, Internal Medicine, Otolaryngology and Emergency Medicine physicians. Together, these  
162 five specialties accounted for nearly 99% of all prescriptions for upper respiratory infections.

163 Inappropriate prescription rate was lowest among the Pediatrics physicians (34%) and highest among  
164 the Emergency Department physicians (74%) among this group.

165

166 There is an increasing recognition and concern about inappropriate antibiotics prescriptions globally.

167 Despite concerns of increasing antibiotic resistance, increasing costs and potential adverse events, there  
168 is no clear indication that inappropriate antibiotic prescription rates are decreasing. After an initial

169 decline in the 1990s and 2000s, the overall prescription rates have stabilized or reversed.<sup>10</sup> There are  
170 significant differences in such prescriptions in various countries, and higher rates of inappropriate  
171 prescriptions are associated with higher rates of antimicrobial resistance.<sup>9,11,12</sup> Upper respiratory tract  
172 infections are by far the most common diagnosis for which antibiotics are prescribed in outpatient  
173 settings, accounting for nearly 80% of all such prescriptions.<sup>13,14</sup> Adherence to guidelines for antibiotic  
174 prescriptions in outpatient setting is low in the absence of active interventions.<sup>4</sup> It has been shown that  
175 behavioral interventions and peer comparison reports can lead to a decrease in inappropriate antibiotic  
176 prescriptions, even in absence of restricting prescriptions or changing how physicians are paid.<sup>11</sup> A  
177 review of literature also suggested that educational interventions were associated with a decrease in  
178 inappropriate prescription in two-thirds of the studies reviewed.<sup>15</sup> Institution of such intervention  
179 programs may be beneficial in the State of Qatar to reduce inappropriate antibiotic use.

180

181 We found that the Emergency Department physicians were more likely to prescribe antibiotics for an  
182 inappropriate indication compared with other specialties. This may be due to the acute nature of the  
183 presenting illness perceived to be severe enough to warrant an emergency department visit, lack of  
184 proper follow up after discharge from the emergency departments, physician related factors or other  
185 unknown causes. Such data may help inform policy makers who to target first in education and  
186 behavioral intervention campaigns.

187

188 An interesting finding was the use of intravenous antibiotics in nearly 5% of the outpatients in our study.  
189 There is rarely a justification for use of intravenous antibiotics in the outpatient setting. While the  
190 inappropriate use among the intravenous prescriptions was only 23% (about half that for oral  
191 antibiotics), the reasons for this are unclear. A diagnosis appropriate for antibiotic prescription may have  
192 led the prescribers to believe that the illness is more severe, or a perception that intravenous antibiotics

193 are more potent, efficacious or effective. Whether patient preferences played a part in such  
194 prescriptions is unknown.

195  
196 Another interesting finding is the lower number of prescriptions during the summer months. In general,  
197 the incidence of upper respiratory tract infections is higher in the winter months. However, the  
198 population movement patterns in the GCC states are such that a large segment of the migrant workers  
199 return to their home countries for the summer break, and the Qatari nationals travel abroad for leisure.  
200 A smaller Qatari population would lead to a smaller denominator or persons seeking treatment, and a  
201 smaller overall population may be associated with lower transmission rates. Whether the lower  
202 numbers in Qatar during the summer months are due to the natural epidemiologic patterns seen around  
203 the world, or due to a much smaller population base in those months warrants further study.

204  
205 A strength of our study is the use of national outpatient data in the private sector. We also retrieved  
206 information on the specialty of the prescribers. Limitations of our study include exclusion of non-Qatari  
207 nationals from the first phase of health insurance scheme, limitation to the private sector providers, and  
208 our inability to generate rates of prescription per unit population (e.g. per 1,000 persons) due to lack of  
209 information on how many persons exclusively seek private sector vs. public sector care. Exclusion of  
210 these groups could lead to under- or over-estimation of inappropriate use. We also did not study the  
211 antibiotic prescription rates for conditions other than upper respiratory tract infections. Another  
212 limitation is the possibility of misclassification of infection by the practitioner. Finally, the etiology of  
213 some of the conditions is not always clear and a small but significant proportion of those with  
214 predominantly viral syndromes may have a bacterial etiology and vice versa.

215

216 In conclusion, there is a high rate of inappropriate antibiotic prescription for acute upper respiratory  
217 tract infections in the private health care sector in the State of Qatar. Further studies are needed to  
218 determine the population based rates across the country. Interventions to decrease inappropriate use in  
219 such settings are urgently needed.

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222 Table 1. Total number of claims by diagnosis and age group.

Diagnosis	All Ages		0 – 17 years		18 – 65 years		>65 years	
	N	%	N	%	N	%	N	%
Antibiotics may be indicated (Appropriate Prescriptions)								
Acute pharyngitis including streptococcal pharyngitis	23,232	56%	10,119	58%	12,826	54%	287	69%
Acute sinusitis including acute maxillary sinusitis	5,908	14%	880	5%	4,957	21%	71	17%
Acute tonsillitis including Streptococcal tonsillitis	12,399	30%	6,382	37%	5,961	25%	56	14%
Influenza with pneumonia	17	0%	15	0%	2	0%	0	0%
TOTAL	41,556		17,396		23,746		414	
Antibiotics not indicated (Inappropriate Prescriptions)								
Acute laryngitis	442	1%	153	1%	284	1%	5	1%
Acute nasopharyngitis including common cold	4,647	14%	2,454	19%	2,155	10%	38	8%
Acute upper respiratory tract infections, including viral URI	28,898	85%	10,088	79%	18,375	88%	435	91%
Influenza	109	0%	33	0%	75	0%	1	0%
Pain in throat	81	0%	27	0%	54	0%	0	0%
TOTAL	34,177		12,755		20,943		479	
Total number of claims	75,733	--	30,151	--	44,689	--	893	--
Inappropriate prescriptions, %	--	45%	--	42%	--	47%	--	54%

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225 Table 2. Total number and proportion of inappropriate claims by specialty of the prescriber.

Specialty	Total Claims, N	Inappropriate Prescriptions, %
General/Family Practice	39,889	50%
Paediatrics	14,066	36%
Internal Medicine	10,658	44%
ENT/Otology	8,691	35%
Emergency Medicine	1,472	74%
Public Health	276	54%
General Surgery	189	32%
Pulmonary Diseases	130	64%
Gastroenterology	91	40%
Nephrology	78	97%
Endocrinology & Metabolism	58	19%
Obstetrics & Gynaecology	44	73%
Infectious Diseases	29	24%
General Scope Nurse	27	37%
Others	35	63%
Grand Total	75,733	45%

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229 Table 3. Cost and proportion of inappropriate us by antibiotic class.

Antibiotic Class	Total Claims, N	Inappropriate Prescriptions, %
Cephalosporin	32,811	44%
Penicillin including combination with enzyme inhibitor	20,912	44%
Macrolides	14,681	52%
Fluoroquinolones	6,498	40%
Others	831	44%
Grand Total	75,733	45%

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231

232 Table 4. Cost and proportion of inappropriate us by route of administration.

Route of Administration	Total Claims, N	Inappropriate Prescriptions, %
PO	72,024	46%
IV	3,627	23%
Undetermined	82	46%
Grand Total	75,733	45%

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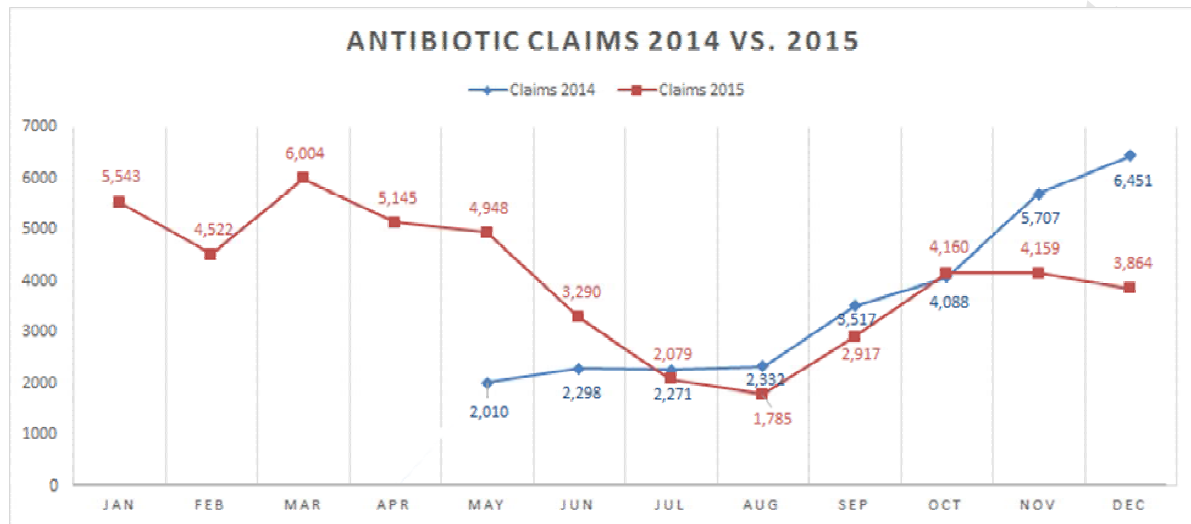
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237 Figure 1. Seasonal variation in prescription of antibiotics to Qatari patients for upper respiratory tract

238 infections.



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