Seasonal Variation in an Outpatient Antibiotic Prescription Rates in Alkharm

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Author’s contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Aim: The aim of this study was to describe the seasonal variations in dispensing antibiotic prescriptions in the outpatient setting of a public hospital in Alkharm.

Methodology: A retrospective cross-sectional study was conducted. The outpatient prescriptions in 2017 and 2018 were collected from medical records in a public hospital in Alkharm. The data include the number of prescribed antibiotics in general, the number of prescribed antibiotics in different months and seasons in the outpatient setting.

Results: In the outpatient setting in 2017 and 2018, antibiotics were prescribed excessively in most of the months. About 27.84% of the prescriptions in 2017 were in spring season and about 26.64% of the prescriptions in 2018 were in autumn. Total number of antibiotics prescriptions in 2017 and 2018 were 5348 in spring followed by 5097 in autumn.

Conclusion: The results of the present study showed the widespread use of antibiotics by practitioners that was associated with season of prescribing. In general, there are excess use of antibiotics in all months. It is important to understand how the prescribing of antibiotic varies throughout the year to design an appropriate intervention to decrease incorrect antibiotic use.

Keywords: Seasonal variation; outpatient; out-patients; antibiotics antibacterial agents.

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1. INTRODUCTION

Antibiotics are drugs that are used to treat and to prevent bacterial infections but not for other infections such as viral infections. Antibiotic resistance occurs when bacteria change in response to the usage of these medicines. Bacteria become frequently resistant to antibiotics. These bacteria may infect not only humans but also animals, and the infections they cause are harder to treat than those caused by non-resistant bacteria [1].

Antibiotic resistance continues to be a threat that affect the efficacy of antibiotics and pose a significant challenge for prescribers who treat patients with bacterial infections. Infections caused by resistant organisms limit the clinicians' management options because there is a lacking in the development and availability of novel antibiotics [2,3]. There is a growing evidence from previous studies that the excessive use of antibiotics is a main risk factor for the development of antibiotic resistance [4,5]. Therefore, to decrease the number of infections caused by resistant bacteria, unsuitable antibiotic prescribing must be decreased [6-11].

In the United States the majority of antibiotics are prescribed in primary care settings for the management of infections in the upper respiratory tract, for which antibiotic therapy is occasionally needed [12–17].

Additionally, most of the antibiotics are prescribed in the first and fourth quarters of the calendar year particularly in winter, because in winter the bacterial and viral illnesses such as influenza and rhinosinusitis are common [18–20].

It is important to identify when and where to use appropriate interventions to decrease antibiotics use in ambulatory care. The aim of this study was to describe the seasonal variations in dispensing antibiotic prescriptions in the outpatient setting of a public hospital in Alkhair in order to identify the opportunity for clinical interventions where seasonal peaks may show increases in unsuitable antibiotic use.

2. METHODOLOGY

A retrospective cross-sectional study was conducted. The outpatient prescriptions in 2017 and 2018 were collected from medical records in a public hospital in Alkhair.

The data include the number of prescribed antibiotics in general, the number of prescribed antibiotics in different months and seasons in the outpatient setting. We included only the most commonly used antibiotics which are amoxicillin / clavulanic acid, amoxicillin, metronidazole, ciprofloxacin, cefuroxime, and azithromycin.

The exclusion criteria include the inpatient prescriptions and the outpatient prescription before 2017 and after 2018, and other antibiotics that were not prescribed commonly.

The data were collected and analyzed using excel software. The data represented by frequencies and percentages. This study is approved by Institutional Review Board Log No. 18-474E.

3. RESULTS

In the outpatient setting in 2017 and 2018, antibiotics were prescribed excessively in most of the months. Table 1 shows the outpatient prescribing of the most common antibiotics in different months in 2017 and Table 2 shows the outpatient prescribing of the most common antibiotics in different months in 2018.

About 27.84% of the prescriptions in 2017 were in spring season and about 26.64% of the prescriptions in 2018 were in autumn. Table 3 shows the outpatient prescribing of the most common antibiotics in different seasons in 2017 and Table 4 shows the outpatient prescribing of the most common antibiotics in different seasons in 2018.

Total number of antibiotics prescriptions in 2017 and 2018 were 5348 in spring followed by 5097 in autumn, 4966 in winter and 4409 in summer. The outpatient prescribing of the most common antibiotics in different seasons in 2017 and 2018 is shown in Table 5 and the total prescriptions in different months are shown in Table 6.

4. DISCUSSION

A high percentage of the prescriptions in 2017 were in spring season (27.84%) and in 2018 were in autumn (about 26.64%). For the total antibiotics use for 2 years in the present study, spring followed by autumn were the seasons of the highest prescriptions more than winter and summer.
Table 1. The outpatient prescribing of the most common antibiotics in different months in 2017

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metronidazole</td>
<td>77</td>
<td>76</td>
<td>70</td>
<td>82</td>
<td>105</td>
<td>81</td>
<td>57</td>
<td>75</td>
<td>62</td>
<td>57</td>
<td>79</td>
<td>75</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>68</td>
<td>78</td>
<td>66</td>
<td>41</td>
<td>56</td>
<td>46</td>
<td>63</td>
<td>80</td>
<td>51</td>
<td>51</td>
<td>53</td>
<td>40</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>74</td>
<td>87</td>
<td>57</td>
<td>38</td>
<td>101</td>
<td>58</td>
<td>70</td>
<td>54</td>
<td>40</td>
<td>38</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>367</td>
<td>304</td>
<td>282</td>
<td>208</td>
<td>334</td>
<td>325</td>
<td>328</td>
<td>389</td>
<td>272</td>
<td>301</td>
<td>364</td>
<td>281</td>
</tr>
<tr>
<td>Amoxicillin/Clavulanic</td>
<td>211</td>
<td>318</td>
<td>269</td>
<td>225</td>
<td>227</td>
<td>189</td>
<td>154</td>
<td>242</td>
<td>218</td>
<td>227</td>
<td>246</td>
<td>150</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>91</td>
<td>85</td>
<td>138</td>
<td>105</td>
<td>76</td>
<td>31</td>
<td>106</td>
<td>86</td>
<td>124</td>
<td>132</td>
<td>81</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>888</td>
<td>948</td>
<td>882</td>
<td>699</td>
<td>899</td>
<td>730</td>
<td>778</td>
<td>926</td>
<td>767</td>
<td>806</td>
<td>844</td>
<td>649</td>
</tr>
</tbody>
</table>

Table 2. The outpatient prescribing of the most common antibiotics in different months in 2018

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metronidazole</td>
<td>133</td>
<td>139</td>
<td>97</td>
<td>81</td>
<td>88</td>
<td>103</td>
<td>96</td>
<td>81</td>
<td>86</td>
<td>86</td>
<td>76</td>
<td>96</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>59</td>
<td>60</td>
<td>55</td>
<td>62</td>
<td>66</td>
<td>62</td>
<td>62</td>
<td>78</td>
<td>67</td>
<td>69</td>
<td>60</td>
<td>73</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>53</td>
<td>56</td>
<td>38</td>
<td>35</td>
<td>43</td>
<td>27</td>
<td>25</td>
<td>43</td>
<td>42</td>
<td>76</td>
<td>31</td>
<td>24</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>306</td>
<td>265</td>
<td>202</td>
<td>270</td>
<td>231</td>
<td>225</td>
<td>321</td>
<td>279</td>
<td>299</td>
<td>396</td>
<td>312</td>
<td>290</td>
</tr>
<tr>
<td>Amoxicillin/Clavulanic</td>
<td>315</td>
<td>306</td>
<td>273</td>
<td>169</td>
<td>208</td>
<td>233</td>
<td>262</td>
<td>336</td>
<td>223</td>
<td>350</td>
<td>257</td>
<td>150</td>
</tr>
<tr>
<td>Azithromycin</td>
<td>82</td>
<td>116</td>
<td>75</td>
<td>86</td>
<td>78</td>
<td>91</td>
<td>118</td>
<td>116</td>
<td>136</td>
<td>67</td>
<td>79</td>
<td>103</td>
</tr>
<tr>
<td>Total</td>
<td>948</td>
<td>942</td>
<td>740</td>
<td>703</td>
<td>662</td>
<td>716</td>
<td>855</td>
<td>859</td>
<td>966</td>
<td>916</td>
<td>908</td>
<td>843</td>
</tr>
</tbody>
</table>

Table 3. The outpatient prescribing of the most common antibiotics in different seasons in 2017

<table>
<thead>
<tr>
<th>Season</th>
<th>Number of antibiotics prescribed</th>
<th>Percentage of antibiotics prescribed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>2718</td>
<td>27.84</td>
</tr>
<tr>
<td>Summer</td>
<td>2328</td>
<td>23.84</td>
</tr>
<tr>
<td>Autumn</td>
<td>2417</td>
<td>24.75</td>
</tr>
<tr>
<td>Winter</td>
<td>2299</td>
<td>23.55</td>
</tr>
</tbody>
</table>

Table 4. The outpatient prescribing of the most common antibiotics in different seasons in 2018

<table>
<thead>
<tr>
<th>Season</th>
<th>Number of antibiotics prescribed</th>
<th>Percentage of antibiotics prescribed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>2630</td>
<td>26.14</td>
</tr>
<tr>
<td>Summer</td>
<td>2081</td>
<td>20.68</td>
</tr>
<tr>
<td>Autumn</td>
<td>2680</td>
<td>26.64</td>
</tr>
<tr>
<td>Winter</td>
<td>2667</td>
<td>26.51</td>
</tr>
</tbody>
</table>

Table 5. The outpatient prescribing of the most common antibiotics in different seasons in 2017 and 2018

<table>
<thead>
<tr>
<th>Variable</th>
<th>Spring</th>
<th>Summer</th>
<th>Autumn</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of antibiotics prescribed in 2017 and 2018 (Total)</td>
<td>5348</td>
<td>4409</td>
<td>5097</td>
<td>4966</td>
</tr>
<tr>
<td>Percentage of total antibiotics prescribed</td>
<td>26.98</td>
<td>22.24</td>
<td>25.71</td>
<td>25.05</td>
</tr>
</tbody>
</table>

Katie J. Suda et al. [21] reported that the antibiotic prescribing is higher in winter than in summer but in their study they compare between the prescriptions in 2 seasons only summer and winter. Similar to this result in our study the prescriptions in winter were higher than in summer but less than autumn and spring. In contrast to our study, the antibiotic prescriptions in winter are more than other seasons as reported by several European and Canadian studies, they stated that the increase in antibiotics use in the winter months ranged from 21% to 42% [19,22-24]. Moreover, Bauchner H et al. reported that antibiotics are
Table 6. The total outpatient prescribing of the most common antibiotics in different months

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescriptions in 2017</td>
<td>888</td>
<td>948</td>
<td>882</td>
<td>699</td>
<td>899</td>
<td>730</td>
<td>778</td>
<td>926</td>
<td>767</td>
<td>806</td>
<td>844</td>
<td>649</td>
</tr>
<tr>
<td>Prescriptions in 2018</td>
<td>948</td>
<td>942</td>
<td>740</td>
<td>703</td>
<td>662</td>
<td>716</td>
<td>855</td>
<td>859</td>
<td>966</td>
<td>916</td>
<td>908</td>
<td>843</td>
</tr>
<tr>
<td>Total Prescriptions</td>
<td>1836</td>
<td>1890</td>
<td>1622</td>
<td>1402</td>
<td>1561</td>
<td>1446</td>
<td>1633</td>
<td>1785</td>
<td>1733</td>
<td>1722</td>
<td>1752</td>
<td>1492</td>
</tr>
</tbody>
</table>
prescribed in winter more than other seasons and that a high percentage of antibiotic prescriptions in the winter are estimated to be unsuitable [25].

Additionally, previous study stated that the use of antibiotic is more in winter and that the excess use of antibiotics in the winter could have a significant effect on resistance [18].

Many physicians prescribe antibiotics to treat viral infections. Seasonal peaks in antibiotics generally used to treat viral upper respiratory tract infections remained unchanged during cold and influenza season [26].

Seasonal influenza viruses are detected year-round, but viruses are most common during the fall and winter. The timing and duration of flu seasons can vary, but generally influenza activity begins to increase in October. Most of the time flu activity peaks between December and February, although activity can last as late as May [27]. In the present study, the highest prescribing was in April followed by March.

Pathak A et al reported that in the peak-prescribing rate of antibiotics was during the summer (75%), while the teaching hospital had a peak prescribing rate during the rainy season (70%) and this study also in contrast to our study [28].

It is noticed that the seasonal variations in prescribing antibiotics are different for the various antibiotics. Highest prescribing rate of metronidazole (a nitroimidazole antibiotic) was in April followed by march, highest prescribing rate of ciprofloxacin (a fluoroquinolone antibiotic) was in October followed by April, highest prescribing rate of cefuroxime (a cephalosporin antibiotic) was in July followed by April, highest prescribing rate of amoxicillin (a penicillin antibiotic) was mainly in December followed by March, highest prescribing rate of amoxicillin/clavulanic acid (a penicillin antibiotic) was mainly in April followed by January and highest prescribing rate of azithromycin (macrolide antibiotic) was in November followed by September.

Amoxicillin/clavulanic acid, metronidazole and cefuroxime were prescribed mostly in spring, ciprofloxacin and azithromycin were prescribed mainly in autumn, amoxicillin was prescribed mainly in winter.

In contrast to our study, Safaeian L, et al. stated that that seasonal peak was observed for penicillins and cephalosporins prescriptions in autumn. But regarding macrolides, similarly he reported that they were significantly more prescribed during autumn [29]. Furthermore, Suda KJ et al. reported that more antibiotic prescribing, predominately driven by the macrolide and penicillin classes, in the outpatient setting was observed in the winter months [21].

5. CONCLUSION

The results of the present study showed the widespread use of antibiotics by practitioners that was associated with season of prescribing. Amoxicillin and amoxicillin/clavulanic acid were the most prescribed antibiotics. In general, there were excess use of antibiotics in all months, but each antibiotic was prescribed more in specific months. It is important to understand how the prescribing of antibiotic varies throughout the year; this will be useful for designing an appropriate intervention strategy to decrease incorrect antibiotic use. Antibiotics should be use as per antibiotic stewardship in order to promote rational use of antibiotics.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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2. Spellberg B, Guidos R, Gilbert D, Bradley J, Boucher HW, Scheld WM, Bartlett JG,


