implementation of the guidelines. Also, prospective studies are needed to establish the true incidence of fatal anaphylaxis after amoxicillin.

Transparency declarations

None to declare.

References


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An econometric view of the dynamic relationship between antibiotic consumption, hand disinfection and methicillin-resistant Staphylococcus aureus

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Sir,

In two recent studies, time-series analysis proved to be a powerful tool to determine the relationship between antimicrobial drug consumption, use of alcohol-based hand rub (ABHR) and the occurrence and spread of methicillin-resistant Staphylococcus aureus (MRSA). A major advantage of time-series analysis is that it establishes a cause–effect relationship with a clear direction and determines the strength of the observed correlation. We compared the results of two studies conducted by Aldeyab et al.1 and Vernaz et al.2 at hospitals in Belfast and Geneva, and for this purpose determined comparable dose–response rates for the two studies.

The dose–response relationship between antibiotic consumption and the emergence of resistance was first described by Phelps,3 who defined it as the percentage change in the probability of an organism being resistant following a 1% change in the level of antibiotic use. In economic science, time-series analysis is used extensively for the analysis of economic relationships (econometrics). In this context, the dose–response rate is termed elasticity and can easily be deduced from the coefficients estimated by time-series analyses.4 In the two studies, elasticity $E_{MRSA,q}$ is defined as:

$$E_{MRSA,q} = \frac{\partial MRSA(q)}{\partial q} \cdot \frac{q}{MRSA(q)}$$

where $MRSA(q)$ stands for the incidence of MRSA, which is a dependent function of the consumption of $q$. The variable $q$ represents the independent variable used in time-series analysis, i.e. a series of the consumption of a class of antimicrobials or a series of ABHR use.

Following this concept, the coefficients estimated by time-series can be transformed into elasticities, thus facilitating comparisons between different study settings. First, estimated coefficients are inserted into the first fraction of Equation (1) $[\partial MRSA(q)/\partial q]$. Second, averages of the dependent variables MRSA and the independent variables $q$ (i.e. antibiotic use and ABHR use series) are inserted into the second fraction $[q/ MRSA(q)]$. The calculated elasticity represents the percentage change in the incidence of MRSA following a 1% change in the level of the variable $q$. For the two studies investigated here, elasticities are shown in Table 1.

A complicating fact is that the two studies used different definitions for MRSA incidence. In Geneva, the incidence of non-duplicate clinical MSRA isolates per 100 patient days was termed MRSA incidence, whereas in Belfast the MRSA incidence was defined as the number of infected or colonized patients per 100 bed-days that became MRSA-positive >=48 h after admission. According to this, a 1% increase in the use of ABHR in Geneva was followed by a 0.35% decrease in the total incidence of MRSA, while a 1% increase in the use of ABHR in Belfast was followed by a 0.22% decrease in the incidence of nosocomial MRSA.

The in-hospital cost of MRSA-related infections represents the major cost driver and is an appropriate indicator for the economic burden of MRSA. Consequently, a drop in the rate of methicillin resistance as well as in the frequency of MRSA colonizations should lead to a reduction in the number of MRSA-related infections. However, this conclusion should be corroborated in future studies in which MRSA infections are analysed separately using time-series analysis to determine comparable dose–response rates.

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Table 1. Coefficients estimated by time-series analysis in Geneva and Belfast and transformation into elasticities

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Vernaz et al.² (Geneva)</th>
<th>Aldeyab et al.¹ (Belfast)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coefficient q/ MRSA⁴ (dose–response rate) elasticity</td>
<td>coefficient q/ MRSA⁵ (dose–response rate) elasticity</td>
</tr>
<tr>
<td>ABHR</td>
<td>-0.032***, lag 0 1.66/0.15 -0.35</td>
<td>-0.0390**, lag 3 0.17/0.09 -0.22</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>0.01***, lag 1 5.41/0.15 0.36</td>
<td>0.0048***, lag 1 5.03/0.09 0.27</td>
</tr>
<tr>
<td>Third-generation cephalosporins</td>
<td>0.014**, lag 4 2.87/0.15 0.55</td>
<td>0.0273***, lag 2 1.06/0.09 0.32</td>
</tr>
<tr>
<td>Macrolides</td>
<td>0.014***, lag 1 2.27/0.15 0.39</td>
<td>0.0021**, lag 4 9.46/0.09 0.22</td>
</tr>
</tbody>
</table>

¹The MRSA incidence is defined as the number of infected or colonized patients per 100 bed-days that became MRSA-positive >48 h after admission.
²The MRSA incidence is defined as the number of non-duplicate clinical MRSA isolates per 100 patient days.
³Simple average of 1.303 L per 100 patient days in 2001 and 2.016 L per 100 patient days in 2006.
⁴Significant at the 1% level. Time lags are given in months.
⁵Significant at the 5% level. Time lags are given in months.

References