Temporal effects of antibiotic use and hand rub consumption on the incidence of MRSA and Clostridium difficile

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Objectives

To determine the temporal relation between the use of:

- antibiotics
- alcohol-based hand rubs (ABHR)

and the incidence of

- methicillin-resistant *Staphylococcus aureus* (MRSA)
- Clostridium difficile
Setting & methods

- Defined Daily Dose (DDD)
- Normalised per 100 patients-days
- Exclude Paediatric and Psychiatry Dpt

- No institutional antibiotic policy
- 2 infection control promotion

- Vigigerme® launched in spring 2003
- “Clean care is safer care” in autumn 2005
Analysis

time-series analysis & intervention model

- Outcomes of interest:

Incidences of non-duplicate clinical isolates of MRSA and C. difficile

- Explanatory variables:

antibiotic usage
bed occupation rate
ABHR use
1) Introduction

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2) Modelling

MRSA model

ABHR model

C. difficile model

3) Results

Transfer function on MRSA incidence

4) Conclusion

MRSA and C. difficile incidence, ABHR consumption
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Antibiotic usage

Average antimicrobial use: 33 DDD/100 patients-days

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\[ \text{Mrsa} = 0.152 + 0.48 \text{Mrsa}_{(t-1)} + \varepsilon_t \]

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Intervention model: 2 hand hygiene campaigns

Interventional model
Residual

ABH

Hopsital Universitaires de Genève

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Intervention model: 2 hand hygiene campaigns

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter (SE)</th>
<th>t-Statistic</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.362 (0.044)</td>
<td>31.22</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>VigiGerme® campaign</td>
<td>0.390 (0.049)</td>
<td>8.03</td>
<td>&lt;0.0001</td>
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<tr>
<td>“Clean care is safer care” campaign</td>
<td>0.189 (0.057)</td>
<td>3.34</td>
<td>0.0013</td>
</tr>
<tr>
<td>ICU delivery 1</td>
<td>0.921 (0.071)</td>
<td>12.90</td>
<td>&lt;0.0001</td>
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<tr>
<td>ICU delivery 2</td>
<td>0.903 (0.076)</td>
<td>11.91</td>
<td>&lt;0.0001</td>
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<tr>
<td>AR (order 1)</td>
<td>0.236 (0.111)</td>
<td>2.13</td>
<td>0.0365</td>
</tr>
<tr>
<td>AR (order 3)</td>
<td>0.447 (0.107)</td>
<td>4.17</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
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Transfer function model on MRSA incidence explains 57% of MRSA variation over time
Transfer function on MRSA incidence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Lag (months)</th>
<th>Parameter (SE)</th>
<th>t-Statistic</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td>-0.079 (0.030)</td>
<td>-2.62</td>
<td>0.0110</td>
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<td>Fluoroquinolones</td>
<td>1</td>
<td>0.010 (0.004)</td>
<td>2.71</td>
<td>0.0088</td>
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<tr>
<td>Macrolides</td>
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<td>0.014 (0.004)</td>
<td>3.61</td>
<td>&lt; 0.001</td>
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<tr>
<td>Macrolides</td>
<td>4</td>
<td>0.012 (0.004)</td>
<td>3.19</td>
<td>0.0022</td>
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<tr>
<td>3rd generation cephalosporins</td>
<td>4</td>
<td>0.014 (0.006)</td>
<td>2.15</td>
<td>0.0352</td>
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<tr>
<td>3rd generation cephalosporins</td>
<td>5</td>
<td>0.015 (0.007)</td>
<td>2.21</td>
<td>0.0309</td>
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<tr>
<td>Cefepime</td>
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<td>0.014 (0.006)</td>
<td>2.56</td>
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<td>Piperacillin/tazobactam</td>
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<tr>
<td>“Clean Care is safer care” campaign</td>
<td>0</td>
<td>-0.032 (0.005)</td>
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<td>Autoregressive term</td>
<td>1</td>
<td>0.546 (0.168)</td>
<td>3.24</td>
<td>0.0019</td>
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<td>Moving average term</td>
<td>1</td>
<td>-0.732 (0.164)</td>
<td>-4.46</td>
<td>0.0000</td>
</tr>
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Transfer function on MRSA incidence

- C. difficile model: $R^2 = 17\%$
- Association with broad-spectrum ceph
- No association with ABHR consumption

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Conclusion

This study demonstrates

- **Effect of 2 hand hygiene campaigns on increasing use of ABHR consumption**

- **Impact of the 2\textsuperscript{nd} hand hygiene campaign on MRSA incidence**

- **Temporal relation of several antibiotic classes on MRSA incidence**

- **No association of ABHR on \textit{C. difficile} incidence**