Estimating the additional indirect cost savings of a procalcitonin algorithm in adult ICU patients with sepsis, as achieved through reduction in antibiotic resistance and C. Difficile...
A procalcitonin algorithm used in adult ICU patients with sepsis saves costs by reducing antibiotic resistance and C. difficile infections

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Introduction

Procalcitonin (PCT) is a specific marker for differentiating bacterial from non-infective causes of inflammation. The reduction in antibiotic days that can be achieved by a PCT algorithm is highly important given the rise in antibiotic resistance. Prolonged antibiotic duration affects the incidence of antibiotic resistance and C. difficile infections, which in this population amounts to 4.7% and 4.6% per hospital episode, respectively.

This study estimates the additional indirect cost savings of a PCT strategy by considering excess length of stay (LOS) due to antibiotic resistance (ABR) and C. difficile.

Methods

The health economic consequences of using a PCT algorithm versus current practice are analysed using a decision tree. Input data were obtained from a systematic literature review and country specific cost data sources. A societal perspective was adopted.

The effect of reduced duration of antibiotic therapy on incidence of ABR and C. difficile and expected cost savings of a PCT algorithm was estimated for the Netherlands.

Cost-effectiveness is expressed as incremental costs per antibiotic day avoided.

Results I

The default values for the reduction in ABR % is based on a linear function. However, the true shape of this function is as yet unknown. To account for this structural uncertainty, two other functions are plotted: an exponential and a logarithmic one.

Every value between the logarithmic and the exponential curve represents a possible reduction in ABR % conditional on the reduction in antibiotic days, showed at the x-axis.

The black square on the dotted line indicates a point estimate of 10% reduction in ABR (range 2% - 20%), at an average reduction in antibiotic days of 1.7 (11.6 - 9.9 ; Table 1).

A similar graph is available on request for the relation between the prescriptions of antibiotic therapy and ABR %.

Results II

The duration of AB therapy is on average 1.7 [95% CI: -2.67; -0.74] days lower under the PCT strategy (Kip, 2015).

- Table 1 shows that, assuming a linear function, this extrapolates to:
  - a relative reduction in ABR of 10% (range 2% - 20%), i.e. from 4.66% to 4.15%
  - a relative reduction in % C. difficile infections of circa 18%, i.e. from 3.40% to 2.80%.

The relation between the duration of antibiotic therapy and the antibiotic resistance rate is based on Singh (2000) and Chastre (2003). The relation between the % of antibiotic prescriptions and ABR is based on Magee et al (1999). The relation between the duration of antibiotic therapy and C. difficile is based on Stevens (2010).

Table 1: Relation between duration of antibiotic therapy and the reduction in antibiotic resistance and C. difficile infection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Without PCT</th>
<th>With PCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of days treated with antibiotics</td>
<td>11.6</td>
<td>9.9</td>
</tr>
<tr>
<td>Antibiotic resistance</td>
<td>4.66%</td>
<td>4.15%</td>
</tr>
<tr>
<td>Prevalence of Clostridium Difficile infection</td>
<td>3.40%</td>
<td>2.80%</td>
</tr>
</tbody>
</table>

Conclusion

- The PCT algorithm reduces AB therapy duration, from which the expected reduction in ABR and C. difficile infections is extrapolated. When reducing ABR and C. difficile infections, the PCT algorithm is expected to generate indirect costs savings beyond the previously published direct health-economic impact (Kip, 2015).

References


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