Economic burden of pertussis outbreak is highly dependent on setting

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BACKGROUND
• Pertussis (whooping cough) is an upper respiratory infection. The classic symptoms of pertussis are a paroxysmal cough which can be accompanied by an inspiratory whoop, and fainting and/or vomiting after coughing.
• Pertussis outbreaks are associated with a substantial increase in resource use that may vary depending on the setting.

OBJECTIVES
• Through a systematic literature review from 2011, this study aimed at better understanding the economic burden of pertussis outbreaks (treatments, hospitalizations, healthcare practitioners (HCP) visits), by setting.

METHODS
• A systematic review of literature on pertussis outbreaks was conducted, including references published between July 2011 and January 2014, using MEDLINE, MEDLINE-IN-PROCESS, EMBASE, Cochrane Library and relevant websites as potential sources.
• No geographical restrictions were set.
• All population-based studies reporting information about epidemiology, burden or costs of pertussis outbreaks were included.

RESULTS
• Out of the 425 records that were identified through the literature search, 33 articles were included in the qualitative synthesis. 3 additional references were found from relevant websites. 38 observational studies from 14 countries were finally included.
• Studies were found to be heterogeneous in terms of settings:
  • 29 outbreaks occurred within a territory (country, region, county, city)
  • 4 outbreaks occurred in a school
  • 2 outbreaks occurred at hospital
  • 2 outbreaks occurred in an isolated community
  • 1 outbreak occurred at university
• Among the 38 studies, 26 studies included descriptions of resources used/costs (references 1 to 26), and 12 studies did not include any references (27 to 38).

1. Treatment (Table 1)
• Pertussis treatment / prophylaxis in the exposed population or pertussis cases was described in 12 references.

Table 1. References reporting treatments, by setting

<table>
<thead>
<tr>
<th>Setting</th>
<th>Reference</th>
<th>Description</th>
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<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital (n=2)</td>
<td>[1]</td>
<td></td>
<td>School (n=4)</td>
<td>[2,6,18]</td>
<td>[2,6,18]</td>
</tr>
<tr>
<td>Territory - City (n=2)</td>
<td>[3,9]</td>
<td></td>
<td>Territory - Region/State (n=2)</td>
<td>[10]</td>
<td>[10]</td>
</tr>
<tr>
<td>Territory - Country (n=1)</td>
<td>[11]</td>
<td></td>
<td></td>
<td>[12]</td>
<td>[12]</td>
</tr>
<tr>
<td>Small or isolated community (n=1)</td>
<td>[13]</td>
<td>[13]</td>
<td>University (n=1)</td>
<td>[14]</td>
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<tr>
<td>Total</td>
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<td>[3,6,18]</td>
<td>[10]</td>
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<td>[12]</td>
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</table>

REFERENCES

2. Hospitalizations and HCP visits (Table 2)
• Hospitalizations
  • Information on the number of hospitalizations in the study population or among pertussis cases was described in 22 references.
  • 18 references reported a hospitalization rate ranging from 0 to 14.8/100,000 for the general population.
  • 22 references reported information on hospitalizations: hospitalization rates ranged from 0% to 8.8% for cases of pertussis and ranged from 0% to 4.3% for small-scale studies (hospital, schools, villages, community, university).
• In 2 references, no hospitalization occurred in the population exposed to the outbreak.
• Length of stay was reported in 2 references: 8.9 days on average in hospital and 13 days in pediatric intensive care unit considering an outbreak at hospital, and a median of 4 days (1 to 48 days) within a territory.
• HCP visits
  • GP or specialist visits were reported in 3 references (2 outbreaks over a territory and 1 outbreak in a school).
  • Nieves et al. provided more information about the number of outpatient visits: during the outbreak, 27% of pertussis cases were admitted to hospital after the first visit, 30% had one earlier visit, 20% had 2 earlier visits and 23% had more than 3 earlier visits.

Table 2. References reporting treatments, by setting

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<td>[12]</td>
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</table>

3. Costs (Table 3)
• Costs reported were costs incurred in controlling the outbreak (4 references).
• Costs per patient were found to be highly variable; this might be explained by the different cost estimation methods and settings.

Table 3. References reporting costs of outbreaks, by setting

<table>
<thead>
<tr>
<th>Reference</th>
<th>Case</th>
<th>Setting</th>
<th>Cost per case (US$)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>N=26</td>
<td>School</td>
<td>1.032.172 (2008 94)</td>
<td>Costs included the labor costs (78% of total), vaccination costs, testing and laboratory costs, administrative costs, hospital costs.</td>
</tr>
<tr>
<td>[3]</td>
<td>N=20</td>
<td>Hospital / Community</td>
<td>2.037.64 (2010 16)</td>
<td>Costs corresponded to the response activity, including labor costs (78% of total), vaccination costs, case and hospitalization costs.</td>
</tr>
<tr>
<td>[5]</td>
<td>Hospital</td>
<td>Total</td>
<td>1.032.172 (2008 94)</td>
<td>Costs included vaccine and administration costs, prophylaxis, laboratory, labor costs.</td>
</tr>
</tbody>
</table>

DISCUSSION
• Underestimation of pertussis burden was often reported. Several reasons were cited, including the decrease in coverage of hospital surveillance leading to underreporting (especially in the older population) and under diagnosis.
• Heterogeneity among articles was high, and significant differences were noted in terms of geographic location, setting, design, population of interest and objectives of the included studies.

CONCLUSIONS
• The extent and the magnitude of outbreaks differed by setting, and the economic burden of pertussis outbreaks was generally underestimated and not always comparable.
• Nevertheless this review showed that pertussis outbreak economic burden may be substantial.