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The role of adults in household outbreaks of pertussis

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Introduction

Since the 1980s, there has been an increase in the number of reported cases of pertussis and of outbreaks of pertussis, even in countries with high vaccine coverage.1-3 In the USA, the burden of pertussis among adults is estimated at around 600,000 cases every year.4-6 It appears that adults—in whom the disease is not severe or easily diagnosed—are an important source of infection transmission to children.7-12 There is evidence that the pertussis vaccine reduces transmissibility in vaccinated children.13,14

This paper reports on the role of adults in 57 household outbreaks of pertussis in Brazil, identified because of a diagnosis of pertussis in a child, and describes pertussis among adults in this setting.

Methods

In 2003 there was a significant increase in the number of pertussis cases referred to the Oswaldo Cruz Hospital. In response to this, an intensive program was set up in Recife in 2003 to refer children with symptoms consistent with per-
tussis to the Oswaldo Cruz Medical School Hospital (HUOC), a sentine surveillance hospital for infectious diseases.

Of the children referred for investigation, 51 received a confirmed diagnosis of pertussis, and their household contacts were investigated. The pertussis immunization status of all children who lived in the same household as adults with pertussis was determined by examination of their health card, with the exception of eight children whose parents informed of their pertussis vaccination status by recall.

Details of the study design have been published in detail elsewhere, but in brief: when parents/guardians of children with suspected pertussis attended the hospital, they were interviewed using a standard questionnaire. Information was collected for all household members and other contacts (relatives and neighbors), including details of age and recent history of cough (presence of symptoms and date of onset). Nasopharyngeal swabs for culture of Bordetella pertussis were collected from suspected cases and all their contacts who had reported a cough within the previous 21 days. When pertussis was confirmed in a household member, all members of the household were enrolled in the study. Definitions of the CDC for pertussis was used: confirmation was done by culture, by epidemiologic linkage with a culture-confirmed case and by household outbreak definitions – an acute cough illness lasting 2 weeks or longer without other symptoms and household exposure to a culture-confirmed case.

Households were treated as the epidemic unit. For the purposes of this analysis, subjects aged 19 years and over were considered adults; those aged under 19 years were considered children/adolescents. We estimated the proportion of household outbreaks in which the infection was introduced by an adult; the proportion of all secondary cases resulting from adults introducing pertussis into the household; the proportion of adult contacts who developed pertussis during the household outbreaks; and the proportion of adult secondary cases in household outbreaks where the primary or co-primary case was another adult. Finally, we calculated the proportion of adult secondary cases in household outbreaks where the primary case was a vaccinated child aged between 7 months and 5 years.

The study was approved by the HUOC Ethics Committee. Patients signed an informed consent form. Results of the analysis of vaccine efficacy and of the dynamics of transmission in the households, which include the identification of all primary cases, have been published elsewhere.

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**Table 1** Frequency of primary cases, co-primary cases, secondary cases, and those with no symptoms among adult household members, by age

<table>
<thead>
<tr>
<th>Case type</th>
<th>Age, years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;19</td>
</tr>
<tr>
<td>Primary case</td>
<td>45 (78.9)</td>
</tr>
<tr>
<td>Co-primary case</td>
<td>5 (62.5)</td>
</tr>
<tr>
<td>Secondary case</td>
<td>76 (81.7)</td>
</tr>
<tr>
<td>No symptoms (not a case)</td>
<td>51 (30.2)</td>
</tr>
<tr>
<td>Total</td>
<td>177 (54.1)</td>
</tr>
</tbody>
</table>

Results are n (%).
infectiousness of recently vaccinated breakthrough vaccinated cases aged between 6 months and 5 years).

Some countries recommend pertussis vaccine for adolescents and adults. The finding that vaccine reduces the transmissibility of breakthrough vaccinated cases suggests that revaccination of adolescents and adults may help to decrease pertussis transmission.9,21,22 Although adults were the primary case in a quarter of the households, they were responsible for 42% of all secondary cases and 40% of all adult secondary cases. In addition, more than 50% of the household members exposed to an adult primary case acquired pertussis. These findings suggest that adults have a major role in the transmission of pertussis to children in households and to susceptible adult household members.

Most (68.8%) adult cases had typical symptoms of pertussis, while the remaining 31.2% reported only an illness with cough lasting at least 14 days. This has been found elsewhere: in one study, 81% (68/84) of adults with pertussis had typical disease and 19% (16/84) had atypical pertussis,18 and in other studies, evidence of pertussis infections was found in adults with persistent cough.23–27 In our study, no adult case, not even those with typical symptoms of pertussis, had pertussis diagnosed before diagnosis of their household child case. Given that healthcare is free and accessible in Brazil, this suggests that pertussis is seldom considered a potential diagnosis in adults even when typical pertussis symptoms are present.22 Previously undiagnosed pertussis was common among adults in household outbreaks of pertussis where the index case was a child. Adults had a substantial role in introducing infection into these households.

This study has some limitations. Pertussis cases were confirmed by culture or epidemiologic linkage with a culture-confirmed case. PCR and serology were not done; had these been done, the number of cases and the secondary attack rate would likely have been higher. Some households had individuals who fulfilled the clinical criteria for a pertussis diagnosis, but they were not included in the study because there were no positive cultures among them. Further, the diagnosis of pertussis among adults was done after the diagnosis of a child household member; we are addressing the potential cases of pertussis not linked to a child. Many adults were primary cases or secondary cases whose disease had started more than 2 weeks before examination in the study. This might have contributed to the low rate of positivity of the cultures. The study only included households where children were the index cases of pertussis; this may have contributed to the young age of contacts, with 70% of the adult contacts being aged between 19 and 39 years. Since adults appear to be an important source of pertussis transmission.9,21,22 Although adults were the primary case in a quarter of the households, they were responsible for 42% of all secondary cases and 40% of all adult secondary cases. In addition, more than 50% of the household members exposed to an adult primary case acquired pertussis. These findings suggest that adults have a major role in the transmission of pertussis to children in households and to susceptible adult household members.

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In conclusion, there is a need to consider pertussis as a differential diagnosis in prolonged cough in adults. Adults, particularly those aged between 19 and 39 years, play an
important role in pertussis transmissibility within the household. A program of pertussis vaccination in adolescents/young adults could decrease the dissemination of pertussis in households.

Conflict of interest: No conflict of interest to declare.

References