The burden of group A streptococcal pharyngitis in Melbourne families


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Background & objectives: There are no recent data from industrialised countries documenting the incidence and costs of group A streptococcal (GAS) pharyngitis. Such data are important in developing policy regarding management (e.g., whether or not to use antibiotics to treat sore throat) and in planning preventive strategies, including preparing for the arrival of GAS vaccines. The present study was undertaken to estimate the incidence and costs of GAS pharyngitis in school aged children in Melbourne, Australia. We report here the results after initial 11 months of surveillance.

Methods: A total of 202 families (852 individuals) with at least one child aged 3 to 12 yr were enrolled across Melbourne in a family-based cohort study, and are being followed prospectively for 24 months. Surveillance data for acute GAS pharyngitis (including serology), throat carriage, and costs of the disease were collected. Additional cases of GAS pharyngitis have been ascertained to improve the precision of costing estimates.

Results: Cohort retention was 97 per cent. The spring, summer and winter carriage rates for children were 13.0, 8.0 and 16.0 per cent respectively. The incidence of GAS pharyngitis was 14 per 100 person-years for children. For every primary case there were 0.7 secondary cases and 24 per cent of families experienced at least one episode of GAS pharyngitis per year. Preliminary costing data suggest that 46 per cent of cases lead to school absenteeism and a high rate of antibiotic use.

Interpretation & conclusion: The present data suggest that GAS pharyngitis remains very common in childhood, and that it has further implications in terms of secondary cases and costs.

Key words Group A streptococcal - Melbourne - pharyngitis

In Australia, sore throat is the second most common reason for which patients see their primary care doctor, and 89 per cent of general practitioners report that they routinely prescribe antibiotics for sore throat1,2. The current debate over the merits of antibiotic treatment of sore throat or group A streptococcal (GAS) pharyngitis in populations where acute rheumatic fever is now rare3, and progress towards development of GAS vaccines4, highlight the need for accurate data documenting the epidemiology and costs of GAS pharyngitis. There have been no prospective studies on the incidence or costs of GAS pharyngitis in populations at low risk of acute rheumatic fever in recent years. We undertook a study aimed to estimate the incidence and costs of GAS pharyngitis in school-aged children in Melbourne, Australia. We used a family cohort design in order to also estimate the incidence of secondary cases, and to measure the burden of this disease on families, rather
than just on individual child. A two-year study is in progress; we report here the results after the initial 11 months of surveillance. This is part of a comprehensive study estimating the burden of all GAS diseases in Victoria.

**Material & Methods**

Two prospective surveillance projects were conducted a family-based cohort study (to determine the incidence and costs), and enhanced surveillance of GAS pharyngitis (to provide additional secondary transmission and costing data). For both studies, participants were recruited from 3 primary care practices in geographically and socio-economically distinct regions of suburban Melbourne. This study was approved by the Ethics in Human Research Committee of the Royal Children’s Hospital.

**Family cohort:** Over a 4 month period starting from August 2001, families with at least one child aged 3 to 12 yr (the highest risk age group for GAS pharyngitis) were enrolled. All families meeting this criterion were identified in each practice, and families were randomly selected for recruitment. They are being followed for 24 months, during which time all episodes of sore throat are being ascertained. When a case of sore throat occurred in any family member, families filled out a diary (for two weeks) including clinical and costing data, and presented to the general practitioner (GP) for a throat swab. If GAS was isolated, the study team visited the family, swabed all household residents, and collected blood for baseline serology from the index case. The study team visited approximately 2 wk later to collect blood for convalescent serology from the index patient, and also from any other family members with a GAS-positive throat swab at the initial visit. In addition, all members of the cohort underwent throat swabbing on three occasions during the first year, to provide seasonal carriage rates of GAS.

All swabs were placed in transport medium specify and cultured within 24 h. Standard culture and typing techniques were used. Anti-streptolysin O (ASO) and anti-deoxyribonuclease B (anti-DNase B) titres were also performed using standard methodologies. GAS infection was considered to be serologically confirmed if either the first or second ASO titre was > 240 IU or anti-DNase B titre was > 300, or if there was a > two-fold rise in titre between acute and convalescent samples. Individuals < 18 yr of age were defined as children and those with ≥ 18 yr of age as adults.

**Enhanced surveillance:** The same primary care practices ascertain additional cases of sore throat, and perform throat swabs. When GAS was isolated, the study team visited the patient, and collected blood for serology, swabs from other household members, and diary data, as for the family cohort study.

**Sample size determination:** Data from the USA during the 1950s and 1960s suggested that 11-20 per cent of school-age children developed symptomatic GAS pharyngitis per year. We conservatively assumed a 10 per cent incidence per year, that families have an average of 1.5 children in the 3-12 yr age group, and allowed for an intracluster correlation of 0.2. A sample size of 160 families would lead to inclusion of 240 children, or an effective sample size of 218 after applying the intracluster correlation. Using this sample size, the precision of estimation of a proportion of 10 per cent would be ± 4 per cent. To accommodate up to a 20 per cent drop-out rate during the year, we planned to enrol 200 families, divided evenly among the 3 General Practices.

**Results**

A total of 202 families were enrolled in the cohort study, consisting of 852 individuals. The median duration of follow up for this study was 11 months, during which cohort retention was 97 per cent. Sixty three families (242 individuals), 66 families (296 individuals) and 73 families (314 individuals) were recruited from the three regions, respectively. Throat carriage rates of GAS in spring, summer and winter were 13.0, 8.0 and 16.0 per cent, respectively for children, and 2.0 per cent in each season for adults.

There were 242 presentations of index (primary) cases of sore throat (190 in children) and 243 secondary cases of sore throat in family members (119 children). Approximately 20 per cent of primary cases were GAS culture positive in children and adults, similar in secondary cases in children, but only 2 per cent in adult secondary cases (Table I). Approximately 90 per cent
of all cases with sore throat and a positive GAS swab also had serological confirmation of GAS infection (Table I).

The incidence of all cases of GAS pharyngitis (primary and secondary) was 14 per 100 person-years for children and 4 per 100 person-years for adults (Table II). For every primary case there were 0.7 secondary cases. There were 44 index cases in 180 family-years at risk (24 cases per 100 family-years).

Preliminary costing data were available only for cases of sore throat, and were unable to be analysed separately for proven GAS pharyngitis. Data were available for 99 cases in children and 24 cases in adults. Overall, 86 per cent of cases attended their general practitioner, and 71 per cent of these visits led to the prescription of a medication. Forty-six per cent of children with sore throat missed school (an average of 14 h of school time missed per child). Importantly, the adult carers of children with sore throat were absent from work or their usual activities for a mean of 12 h, in order to care for their child. Adults with sore throat missed an average of 14 h of work or their usual activity.

### Discussion

The most comprehensive published study of sore throat followed a group of Cleveland families from 1948-52, and documented an incidence of symptomatic GAS pharyngitis ranging from 1.1 per 1,000 person-days in 5-7 yr olds to 0.17 in adults, with an overall incidence of 0.20 per person-year in children. Two other studies from the USA during the 1960s reported incidences of 0.15 and 0.22 per person-year in children. A recent prospective study came from a region of Auckland, New Zealand, with a large Maori and Pacific Islander population. In this population, where poverty and household crowding were greater than in suburban Melbourne, there were an average of 7 sore throats in school children each year, and 50 per cent of children had a GAS culture-positive sore throat each year. Another prospective study from India found an incidence of GAS culture-positive sore throat in children of 0.95 per child-year. Neither of the latter two studies used serology to confirm culture-positive cases. Therefore, there are no recent data from industrialised countries that allow an estimate of the incidence of proven GAS pharyngitis in school-age children, and no data at all on the costs or burden of this disease on families and the wider community.

The present study demonstrated that 14 per cent of children in urban Melbourne developed GAS pharyngitis each year, and that 24 per cent of families experienced at least one episode of GAS pharyngitis each year. A high rate of secondary transmission was also found. Preliminary costing data suggested high rates of school and work absenteeism, and that most cases of sore throat in this cohort received prescribed medications (in most cases, this was likely to be an antibiotic). Clearly, these data confirm that GAS pharyngitis remains an important problem for children and families in affluent communities, and that the overall direct and indirect costs are likely to be substantial. These data will be important in determining the most appropriate recommendations regarding antibiotic treatment of sore throat, and in developing cost-effective control strategies. These will also be critical in developing models of strategies for the

### Table I. Number of positive throat swabs and proportion with positive anti-streptococcal serology, during 11 months of follow up of a cohort of 852 individuals

<table>
<thead>
<tr>
<th>Case group</th>
<th>Swabs taken during sore throat</th>
<th>GAS culture positive (%)</th>
<th>GAS culture and serology positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index cases:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>242</td>
<td>50 (21)</td>
<td>44 (88)</td>
</tr>
<tr>
<td>Adult</td>
<td>52</td>
<td>12 (23)</td>
<td>11 (92)</td>
</tr>
<tr>
<td>Children</td>
<td>190</td>
<td>38 (20)</td>
<td>33 (87)</td>
</tr>
<tr>
<td><strong>Secondary cases:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>243</td>
<td>32 (13)</td>
<td>29 (91)</td>
</tr>
<tr>
<td>Adult</td>
<td>124</td>
<td>3 (2)</td>
<td>3 (100)</td>
</tr>
<tr>
<td>Children</td>
<td>119</td>
<td>29 (24)</td>
<td>26 (90)</td>
</tr>
</tbody>
</table>

*percentage of those already culture-positive. Serology positive – Either first or second anti-streptolysin O titre ³ 240 IU or anti-DNase B titre ³ 300 IU, or ³ two-fold rise in titre between acute and convalescent titres.

<table>
<thead>
<tr>
<th>Table II. Incidence of culture and serologically-proven group A streptococcal pharyngitis in an 11 month cohort study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case group</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>Children</td>
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use of GAS vaccines, which are already in phase two clinical trials.

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References


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