Exploring the benefits of molecular testing for gonorrhoea antibiotic resistance surveillance in remote settings

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On behalf of GRAND investigator team

Gonorrhoea in remote Australia
• Disproportionately high diagnostic rate
  • 35 times higher than in urban setting
• Prevalence up to 8% among 16-34 age group
  • More than 10% for 16-19 age group
• High community screening coverage (70%+)
• High treatment rate (75%+)

Gonorrhoea antimicrobial resistance (AMR)

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of isolates tested</th>
<th>Resistance to penicillin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
</tr>
<tr>
<td>Australia (urban)</td>
<td>3647</td>
<td>1034</td>
</tr>
<tr>
<td>Australia (remote)</td>
<td>459</td>
<td>19</td>
</tr>
<tr>
<td>Western pacific region</td>
<td>8484</td>
<td>3013</td>
</tr>
</tbody>
</table>

Source: Lahra et al. 2013

Molecular test for AMR surveillance
• In NHMRC funded GRAND study, David Whiley and colleagues have been developing molecular PCR tests to identify genetic mutations that confer resistance
• Improve coverage and representativeness of AMR surveillance
• Inform clinical guidelines

Detecting and treating gonorrhoea
• Recommended treatment ([www.sti.guidelines.org.au](http://www.sti.guidelines.org.au))
  • Principal treatment option: ceftriaxone + azithromycin
  • For regional/remote: amoxycillin (+ azithromycin when chlamydia not excluded)
• Diagnosis
  • Majority through nucleic acid amplification tests (NAAT) test, due to distance and transport consideration, convenience and high sensitivity
  • Not many samples available for culture, which is needed to test antibiotic susceptibility

Modelling
• We developed an individual-based mathematical model to describe the transmission of gonorrhoea in a remote Indigenous population in Australia
• Estimated the impact of the molecular test on the time delay between first occurrence and the first confirmation that the prevalence of gonorrhoea AMR has breached the WHO-recommended 5% threshold
AMR monitoring scheme

- Resistance proportion: the percentage of infection in the population that is attributable to treatment-resistant gonorrhoea

- An alert is triggered when more than 5% of the last 200 positive diagnoses (for which AMR is determined) are resistant to treatment

Outputs

- The resistance proportion in the population when the alert is triggered

- The delay between the time when the actual resistance proportion in the population breaches the 5% threshold and time when the breached detected the surveillance system (i.e. triggering of the alert).

Example

![Chart showing resistance proportion over time](chart1.png)

Example – insufficient sample size

![Chart showing resistance proportion over time with small sample size](chart2.png)

AMR surveillance – without molecular test

<table>
<thead>
<tr>
<th>Percentage of diagnoses where AMR can be detected</th>
<th>17% (WA)</th>
<th>22% (NT)</th>
<th>30% in male, 50% in Female (FNQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance proportion at the time alert is triggered</td>
<td>17.8%</td>
<td>12.5%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Time between first instance of resistance proportion exceeding 5% and time of alert</td>
<td>36.5 months</td>
<td>26.2 months</td>
<td>11.7 months</td>
</tr>
</tbody>
</table>

AMR surveillance – with molecular test

<table>
<thead>
<tr>
<th>Percentage of diagnoses where AMR can be detected</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance proportion at the time alert is triggered</td>
<td>6.8%</td>
<td>6.2%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Time between first instance of resistance proportion exceeding 5% and time of alert (months)</td>
<td>6.0 months</td>
<td>4.2 months</td>
<td>3.4 months</td>
</tr>
</tbody>
</table>
Findings

• AMR surveillance would be enhanced by the use of a molecular resistance test at diagnosis by enabling more timely detection of resistance

• This could facilitate earlier treatment switching, which has the potential to reduce the population impact of gonorrhoea AMR

• With increased number of sample available for AMR surveillance, adjustment to AMR monitoring scheme might be required to prevent premature triggering of the alert.

Disclosure of Interest

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References


