Oropharyngeal Neisseria and antimicrobial resistance of Neisseria gonorrhoeae

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Antibiotic consumption
Gonorrhea and pharynx
ICON study in Vietnam
Potential directions
Global antibiotic use up by **36%**  
Cephalosporins up by **93%**
Cephalosporin use up due to increased use in Asia

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>India</th>
<th>UK</th>
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<tbody>
<tr>
<td>Broad-spectrum penicillins</td>
<td>1 × 10⁴</td>
<td>1 × 10⁵</td>
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<tr>
<td>Cephalosporins</td>
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<td>Macrolides</td>
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<td>Fluoroquinolones</td>
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<td>Trimethoprim</td>
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<td>Tetracyclines</td>
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<tr>
<td>Narrow-spectrum penicillins</td>
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<td>Monobactams</td>
<td>1 × 10⁶</td>
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<td>Polymyxins</td>
<td>1 × 10⁷</td>
<td>1 × 10⁸</td>
<td>1 × 10⁷</td>
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<td>Penicillin-streptomycin combinations</td>
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<td>Carbacephems</td>
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</tbody>
</table>

Standard units
Antibiotic overusage causes selective pressures for bacteria:

- Repeated/endemic pathogen infections
- Inappropriate treatment / dosage / duration
- Agricultural / environmental
Are we gathering enough data in time **to do something about it?**
Is this all happening in the pharyngeal ‘swap-meet’?

- Cases of ceftriaxone resistance almost exclusively from pharyngeal specimens
- Pharyngeal gonorrhea is asymptomatic and prevalent (in sexually active MSM)
- Pharynx is site of many commensal non-pathogenic or opportunistic Neisseria species
Neisseria’s high capacitance for horizontal genetic transfer

- Neisseria known for DNA uptake and transformation, especially within genus
- Resistance from non-mosaic elements and mosaic PBP 2 – regions from N. cinerea and N. perflava
- Pathogenic Neisseria may have more capacity for genetic exchange
The “commensal reservoir” is often mentioned, where are the data???
Hanoi, Vietnam presented itself as an appropriate opportunity.

- In Vietnam, antibiotics are readily available without prescription at almost every corner.
- High levels of antibiotic resistance.
- High risk populations with elevated oral STIs.
Bacterial Traits

Bacteria

Personal Traits

Person

Study Participant

High Cephalosporins

Neisseria?

Not resistant?

Resistant?

No Neisseria?

No / Low Cephalosporins

Neisseria?

Not resistant?

Resistant?

No Neisseria?
Bacterial Traits

Bacteria

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Neisseria?

Resistant?

Not Resistant?

Questionnaire

Microbiology
Tablet Questionnaire - REDCap

- Self answer without sharing answer to researcher
- Skip logic
- Accessible via any laptop or tablet
Ongoing Study…

- **Questionnaire**  
  - **N = 148**
  - **Age (years, med)** 24 (18 – 40)
  - **Sexual behavior**
    - MSM only 64 %
    - Transactional 13 %
  - **Partners (6M, med)** 2 (0 – 211)
  - **History of STIs**
    - Gonorrhea 15 %
    - HIV 4 %
MSM in Hanoi are using antibiotics.

Any antibiotics in the last 6 months:

- No: 38%
- Yes: 62%

Within the last 30 days:

- Yes: 51%
Many use Antibiotics without prescription

- NO PRESCRIPTION LAST TIME: 61.3%
- STOPPED TAKING WHEN SYMPTOMS STOP: 13.7%
Some are using cephalosporins
From pharynx to E-test
Neisseria were present in all samples.

<table>
<thead>
<tr>
<th>Neisseria species</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Neisseria cinerea</td>
<td>5%</td>
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<tr>
<td>Neisseria flavescens</td>
<td>71%</td>
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<tr>
<td>Neisseria mucosa</td>
<td>24%</td>
</tr>
<tr>
<td>Neisseria subflava</td>
<td>34%</td>
</tr>
<tr>
<td>Neisseria meningitidis</td>
<td>3%</td>
</tr>
<tr>
<td>Neisseria gonorrhoea</td>
<td>11%</td>
</tr>
</tbody>
</table>

* many plates had more than one Neisseria species

Figure 2: Prevalence of Neisseria species carried by age group.
Some Neisseria had "reduced susceptibility"
Antibiotic users more likely “reduced susceptibility” to Cephalosporins.

- **NO ANTIBIOTICS (6M)**
  - Susceptible: 87%
  - Reduced Susceptibility: 13%

- **ANY ANTIBIOTICS (6M)**
  - Susceptible: 67%
  - Reduced Susceptibility: 33%
CFX/CTX users more likely “reduced susceptibility” to Cephalosporins

**NO CFX/CTX (6M)**
- Susceptible: 80%
- Reduced Susceptibility: 20%

**ANY CFX/CTX (6M)**
- Susceptible: 50%
- Reduced Susceptibility: 50%
Next steps

- Do different Neisseria have different capacity for acquiring resistance?
- How similar are genetic components in resistance?
- Can we use commensals as surveillance for future resistance trends?
The ICON Research Team

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