Antimicrobial resistance is an increasingly serious health issue in Ontario and worldwide. As more antimicrobial drugs become ineffective and fail to treat a growing number of infections, those infections persist and increase the risk of disease, poor health and death. Action is required to ensure the use of antimicrobials only when necessary to safeguard the availability of future treatments for both common and serious infections.

### History of Antimicrobial Resistance: Example of *Neisseria gonorrhoeae*

Continuing and growing antimicrobial resistance in *Neisseria gonorrhoeae*, the organism that causes gonorrhea, means that gonorrhea may soon become untreatable as no new drugs are in development. Of the many drugs used for decades to fight gonorrhea, only ceftriaxone continues to be effective, and their efficacy has begun to wane. While over 20 antibiotic classes were marketed between 1930 and 1962, only two new classes have been approved for sale since that time. This example shows the history of antibiotics used to treat gonorrhea, and reflects increased resistance of many drugs to an increasing number of infections:

<table>
<thead>
<tr>
<th>Year</th>
<th>Antibiotic</th>
<th>Resistance Year</th>
<th>Resistance Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td>Penicillin</td>
<td>1976</td>
<td>5%</td>
</tr>
<tr>
<td>1932</td>
<td>Sulfonamides</td>
<td>1998</td>
<td>2%</td>
</tr>
<tr>
<td>1944</td>
<td>Tetracyclines</td>
<td>1985</td>
<td>11%</td>
</tr>
<tr>
<td>1948</td>
<td>Macrolides</td>
<td>1977</td>
<td>0.063</td>
</tr>
<tr>
<td>1949</td>
<td>Chloramphenicol</td>
<td>1953</td>
<td>0.016</td>
</tr>
</tbody>
</table>

### IMPLICATIONS OF ANTIMICROBIAL RESISTANCE

As antimicrobial resistance increases, more currently treatable diseases will become untreatable, leading to increased infection, complications and death.

- **Increased treatment failure**
- **Increased mortality**
- **Emergence of multidrug-resistant organisms**
- **Use of alternative antimicrobials that are less effective and more toxic**

### STOPPING ANTIMICROBIAL RESISTANCE

Addressing the growing threat of antimicrobial resistance will require shared and coordinated action.

- **Public Health**
  - Focus on the prevention of infections
  - Surveillance to detect emergence of resistance

- **Researchers**
  - Explore new antimicrobials and combination therapies
  - Study ways to mitigate the development of resistance

- **Clinicians**
  - Antimicrobial stewardship – prescribe antimicrobials only when required
  - Use the right drug, at the right dose, for the right duration

- **Industry**
  - Minimize the use of antimicrobials for agricultural use

### ORGANISMS OF CONCERN

Laboratory testing for resistance and whether or not it is increasing over time provides a warning that treatment may lose effectiveness. Many organisms, primarily acquired in community settings, are showing concerning levels of resistance to the antimicrobials routinely used to treat infection. Examples of these include:

- **Chlamydia trachomatis**
  - Resistance to tetracycline and azithromycin

### History of Antimicrobial Resistance: Example of *Neisseria gonorrhoeae*

Continuing and growing antimicrobial resistance in *Neisseria gonorrhoeae*, the organism that causes gonorrhea, means that gonorrhea may soon become untreatable as no new drugs are in development. Of the many drugs used for decades to fight gonorrhea, only ceftriaxone continues to be effective, and their efficacy has begun to wane.

- **Factors contributing to resistance**
  - Misuse and overuse of antimicrobials have increased the pathogen spread and rates of resistance.
  - Patients with routine infections, such as urinary tract infections (UTIs), are at higher risk for serious complications when the microbe is drug-resistant.
  - The need to preserve the effectiveness of established antibiotics is critical, as antibiotic discovery is costly, slow and ultimately uncertain.

### THE ISSUE AT A GLANCE

- **How Antimicrobial Resistance Occurs**
  - Resistance can exist naturally, happen through mutation, or happen by picking up resistant genes from other microbes. Microbes not killed by antimicrobials survive and multiply, leading to the emergence of strains that are partially or fully resistant to antimicrobial treatment.

### HOW ANTIMICROBIAL RESISTANCE OCCURS

- **Microbes multiply by the millions.**
- **Genetic changes in the organisms occur and can lead to a small number with antimicrobial resistance.**
- **Antimicrobial medications are introduced.**
- **Antimicrobial-resistant microbes survive.**
- **Drug-resistant bacteria multiply and thrive.**

### A PUBLIC HEALTH THREAT

Antimicrobial resistance is an increasingly serious health issue in Ontario and worldwide. As more antimicrobial drugs become ineffective and fail to treat a growing number of infections, those infections persist and increase the risk of disease, poor health and death. Action is required to ensure the use of antimicrobials only when necessary to safeguard the availability of future treatments for both common and serious infections.

** Shut the door to drug resistance! **

**Ontario Antimicrobial Resistance Group for Public Health**

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**For more information, visit:** publichealthontario.ca