



ANTIMICROBIAL RESISTANCE (AMR)

develops when microorganisms evolve such that treatments become less effective – or do not work at all.¹

Laboratory Medicine plays a key role in combatting the development of AMR.²

The Pan-Canadian Framework for action on tackling AMR and antimicrobial use includes **surveillance, infection prevention and control, antimicrobial stewardship,** and **research and innovation.**³

Rapid diagnostics can determine if an infection is bacterial or viral, identify bacterial type(s), identify any drug resistance, and assess drug susceptibility, thereby **changing the way antibiotics are used.**⁴

The Scope of the Problem



10 MILLION DEATHS

due to the effect of AMR predicted by 2050 –
a **14.3-fold increase** from now.⁵

1/16 PATIENTS

admitted to hospital will get a
multi-drug resistant infection.¹

Methicillin-resistant *Staphylococcus aureus* (MRSA)
infections have **increased by 60%** since 2012.⁶

More than 50% of all gonorrhea infections are
resistant to at least one antibiotic.⁶



\$100 TRILLION

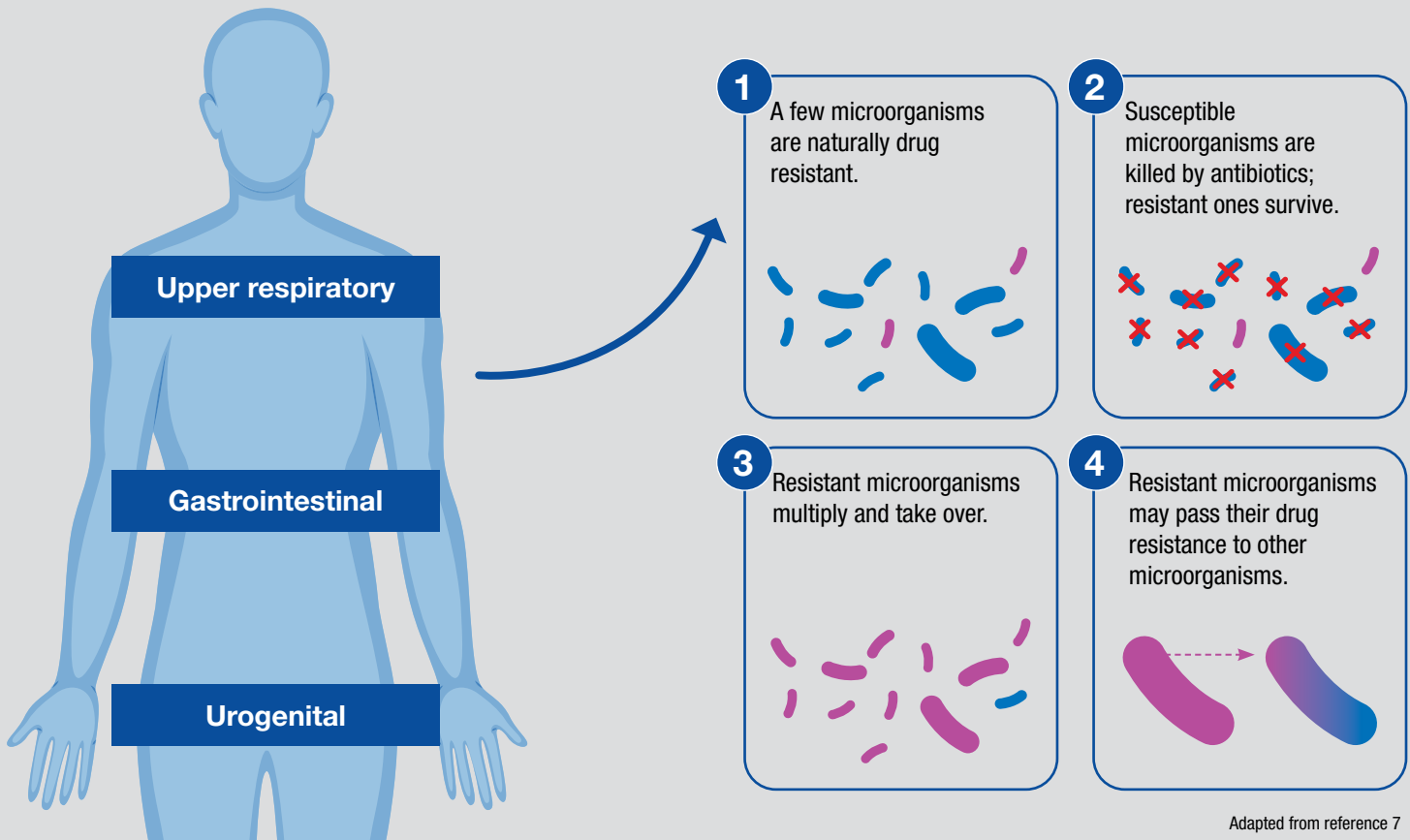
in **lost productivity** globally
predicted by 2050.⁵

\$250 MILLION

spent on **direct medical costs** annually.¹

How AMR Develops

AMR occurs naturally but emergence and spread increase with inappropriate or over use of antimicrobials.¹



Mitigating AMR

Developing and implementing effective infection prevention and control measures reduces the risk of transmission of pathogens in healthcare and community settings.⁸



Combatting AMR plays a critical role in patient care.



Combatting AMR delivers on the *Quadruple Aim*



Improve patient outcomes

Mortality can be **reduced by 58%** using rapid identification and susceptibility techniques in Gram-negative bacteremia.⁹

Infection control isolation can be **reduced by 4 days** using rapid syndromic testing of patients with respiratory infections.¹⁰

Underdiagnosis delays proper treatment, may cause the patient's condition to worsen, and **increases the cost of eventual appropriate treatment**.¹¹

Appropriate laboratory reporting encourages antimicrobial stewardship, improving optimal use of antibiotics.¹²

Rapid testing and improved results communication of *S. aureus* bloodstream infections speeds up **appropriate antibiotic treatment**.¹³

MALDI-TOF MS for bacterial identification has a **rapid TAT**, can identify a comprehensive list of organisms, and has a low cost per isolate.¹⁴

In bacteremia, **LOS** and **absolute mortality risk can be reduced by 62.5% and 3.79%**, respectively, using MALDI-TOF short incubation of blood cultures.¹⁵

Rapid molecular blood tests can **reduce antimicrobial consumption** through early de-escalation compared to conventional blood cultures in patients with positive microbiological tests.¹⁶

LOS = length of stay; MALDI-TOF MS = matrix-assisted laser desorption/ionization-time of flight mass spectrometry; TAT = turnaround time



Improve healthcare sustainability

Laboratory testing represents **only 4%** of healthcare budgets but **informs 50-70%** of clinical decisions.^{11,21-24}

Use of rapid diagnostics reduces LOS by **8 days (34%)** and time in ICU by **5.3 days (33%)** in patients with Gram-negative bacteremia.⁹

Isolation time can be reduced by 4 days using PCR rapid testing in respiratory infections.¹⁰

Inappropriate use of laboratory/diagnostic services leads to **significant costs** to patients, physicians and the healthcare system, and possible unnecessary care.¹¹

Estimates of **inappropriate laboratory testing** range from **16 to 56%**.¹¹

By 2050, drug-resistant infections (AMR) could cause **global economic damage** similar to the 2008 financial crisis.²⁵

Targeted antibiotic results are available faster using improved technologies and diagnostic approaches.²⁶



Improve health of general population

The effect of AMR will lead to **more deaths than cancer and diabetes combined** by 2050.¹

Influenza testing technology that reduces TAT from days to hours reduces overall isolation days during influenza season.²⁷

Rapid, highly sensitive tests could facilitate the **earlier detection of influenza**, permitting **appropriate medical management** and a **reduction in transmission**.²⁸⁻³⁰

The emergence of resistance at the population level can be averted by preventing the emergence of resistance in a treated host.³¹

The **estimated burden of antibiotic resistant infections** in the EU and EEA is **170 DALYs**, approaching the **183 DALYs** for influenza, tuberculosis, and HIV combined.³²

Using a **multidisciplinary approach** improves antibiotic prescribing for UTIs in the Emergency Department.³³

Improved communication of virology results is associated with **reduced duration of antibiotic use** in viral respiratory infections.³⁴

DALY = disability-adjusted life-years; EEA = European Economic Area; UTI = urinary tract infection



Improve care team well-being






The **transmission** of antibiotic-resistant bacteria occurs **through contact among patients and health care workers**.¹⁷

Approximately 5% of healthcare workers carry MRSA and there are concerns of its transmission to patients.¹⁸

Committing to improving our understanding of reservoirs of **emerging resistant pathogens** (e.g., carbapenemase-producing Enterobacteriaceae in the healthcare setting and beyond).¹⁹

Health care team well-being is **linked to patient experiences**.²⁰

Emerging Trends in Combatting AMR

Pathology/Technology	Benefit or Rationale
 <p>Rapid diagnostic and susceptibility tests for bacteriuria/urinary tract infections</p>	Determines if antibiotics are indicated and directs selection of the best one.
 <p>Syndromic panels for gastrointestinal infections</p>	Timely diagnosis of pathogens such as <i>Clostridium difficile</i> allows prompt treatment.
 <p>Rapid molecular or mass spectrometry based detection of resistance determinants</p>	Helps prevent outbreaks (e.g., MRSA, vancomycin-resistant enterococci).
 <p>Monitoring of hypotension in sepsis</p>	Allows timely administration of antibiotics.
 <p>Modified reporting (e.g., in asymptomatic bacteriuria)</p>	Reduce inappropriate antibiotic use. ¹²

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