

...Then continue!

Trigger the scenarios in order, adding the corresponding risks and consequences's cards.

2nd MODULE :

Actions

Players are invited to pick a card that represents an action to combat antibiotic resistance.

They must then take turns explaining why this card caught their attention. What potential links can be made with the risk/consequence cards?

The goal is to end the workshop on a positive note, where everyone has a role to play both individually and collectively.

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MICROBIOTA FRESK

Antibiotic Resistance Workshop for
Healthcare Professionals

This 'print-yourself' version of the microbiota fresk consists of 2 modules:

1 "arrow" card



1st MODULE

44 cards
(24 scenario
cards, 5 risk
cards et 15
consequence
cards.)



2nd MODULE

19 cards

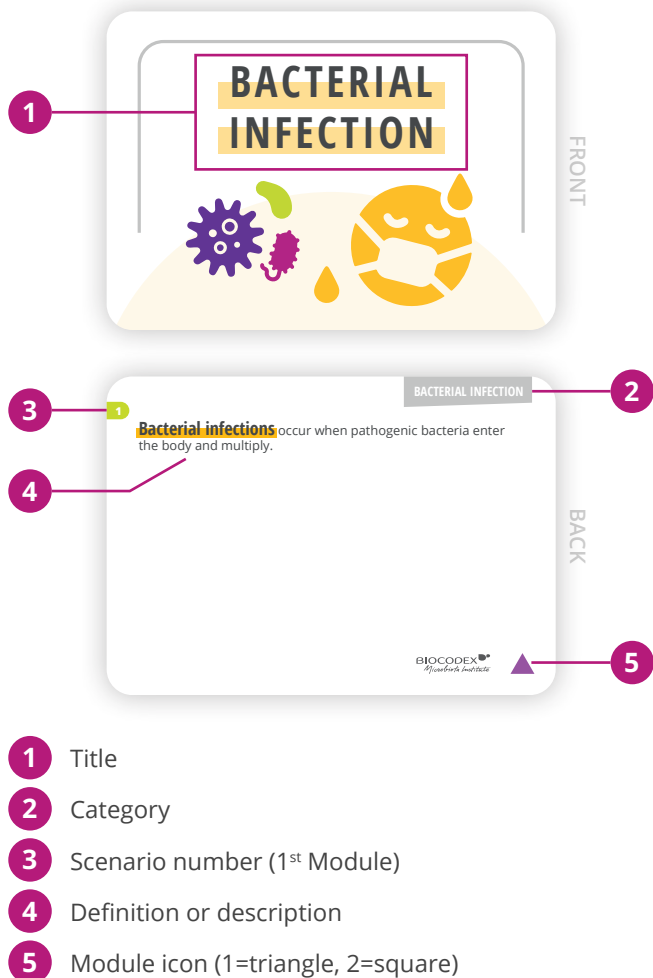


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Use scissors to cut on stippling

Fold paper on lines





How to?

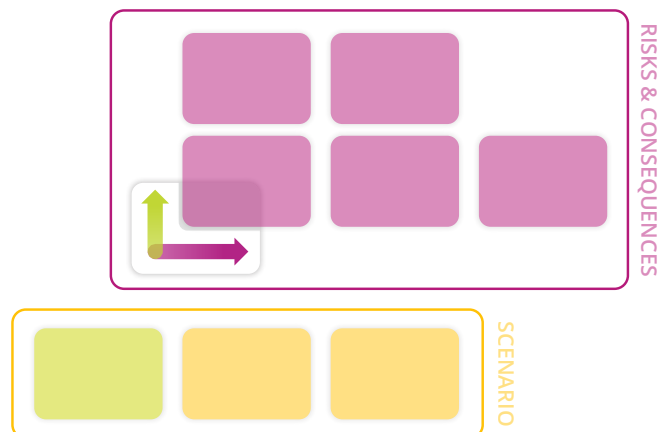
The modules are played sequentially and in **collaboration**. Place your cards face down and try to organize them while **discussing your thought processes**.

You can read the backs of the cards to guide you.

2nd MODULE :

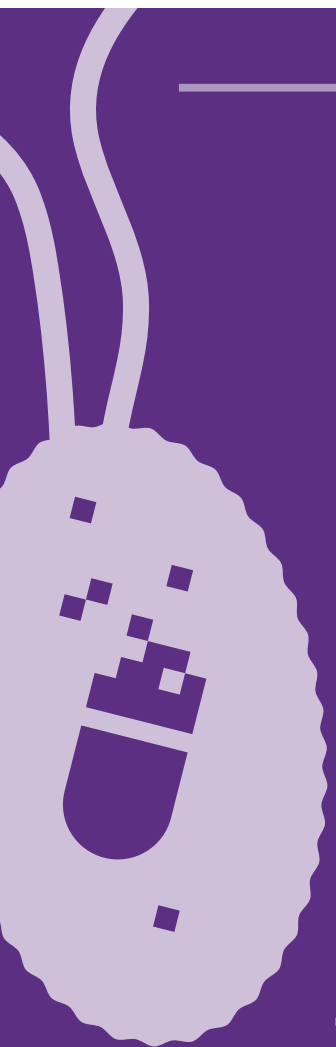
Classic case: Bacterial and viral infections

Use the first scenario **1** to introduce the mechanics of module 1. Use the "arrow" card to arrange the risks and consequences.





RESISTANCE TRANSMISSION



EMERGENCE OF RESISTANT BACTERIA



EMERGENCE OF MULTIDRUG-RESISTANT BACTERIA



Bacteria can become resistant to an antibiotic by developing a **genetic mutation, either spontaneously or caused by exposure to antibiotics.**

This phenomenon is known as resistance.



Some bacteria have mechanisms of resistance to several classes of antibiotics.

Carbapenem-resistant *Enterobacteriaceae* and *Acinetobacter* are examples of multidrug-resistant bacteria.



Bacteria are able to pass their resistance on to their offspring and also to other bacteria in their presence through gene transfer.

The presence of resistant bacteria in an environment **can promote the transmission of resistance** to other pathogenic or non-pathogenic bacteria.



DYSBIOSIS



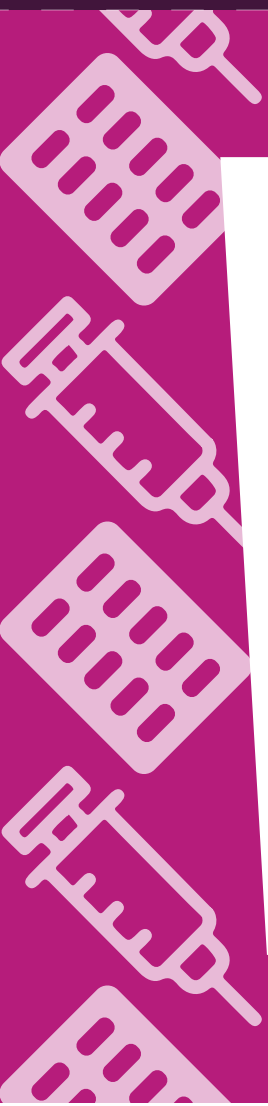
**RESISTANT
PATIENTS**



**INCREASE IN
SECONDARY INFECTIONS**



**OVER-UTILIZATION
OF MEDICAL
RESOURCES**



PATIENT RISK

The spread of resistant bacteria is leading to a significant increase in the number of **patients infected with strains that are not susceptible to current antibiotics**, and thus represents a major public health challenge.



PERSONNAL HEALTH RISK

Resistant infections **lengthen the duration of care and require more human and material resources**, making adaptation of treatment more complex and increasing the workload of healthcare staff.



PATIENT RISK

Antibiotics can eliminate some commensal bacteria, leading to **an imbalance in the microbiota**.

This phenomenon, known as **dysbiosis**, alters both the diversity and function of this microbial ecosystem essential to health.

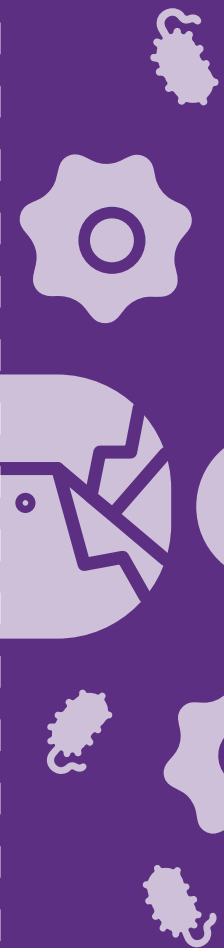


PATIENT RISK

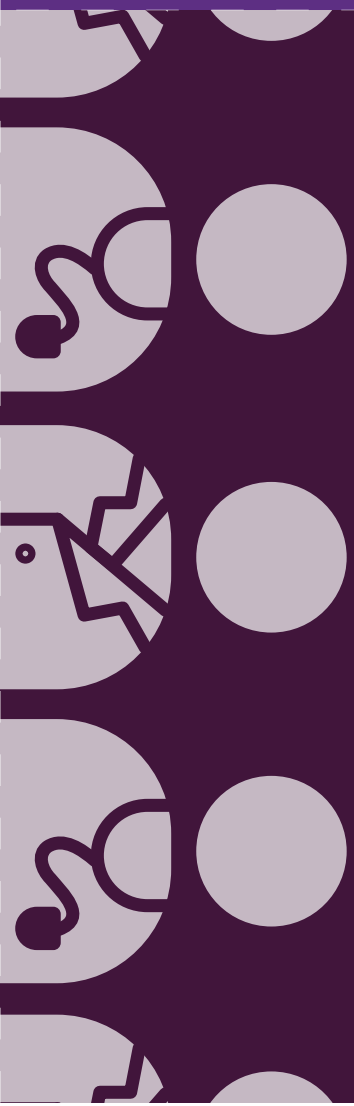
The **increasing inefficacy of standard treatments** in the face of resistant or even multidrug-resistant bacteria is leading to an **upsurge in infections** and a worsening of initially benign cases, which can in some cases lead to a fatal outcome.



**(OVER)EXPOSURE
OF HEALTHCARE
PERSONNEL**



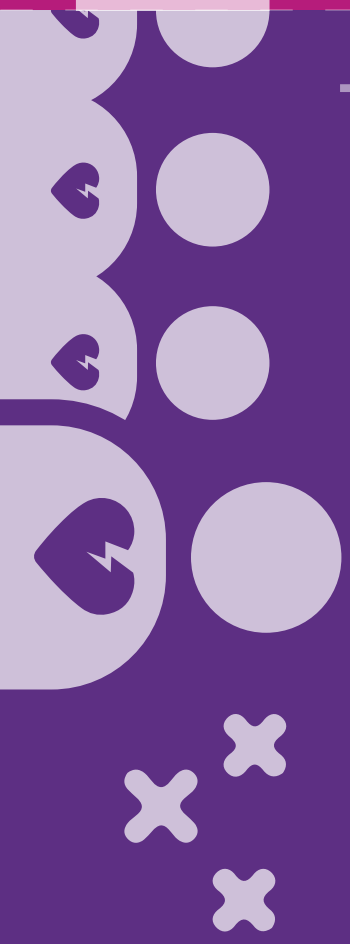
**PRESSURE ON
HEALTHCARE STAFF**



**OVERCROWDING OF
THE HEALTHCARE SYSTEM**



**SPREAD OF
INFECTIONS**



PERSONNAL HEALTH RISK

The increase in the number of **resistant patients**, the **over-exposure of medical staff** and the **use of extensive treatments** can create **added pressure on healthcare staff**, particularly in contexts that are already strained or under-resourced.



HEALTHCARE SYSTEM RISK

On a national scale, the rise in bacterial resistance could encourage **the spread of hard-to-treat infections**, threatening the efficacy of treatment on a large scale.



PERSONNAL HEALTH RISK

The increase in the number of cases further **exposes healthcare workers to resistant bacteria**, making them themselves **susceptible to infection** and **potential vectors of transmission**.

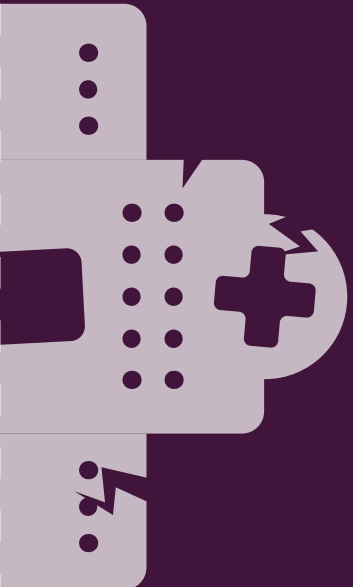


HEALTHCARE SYSTEM RISK

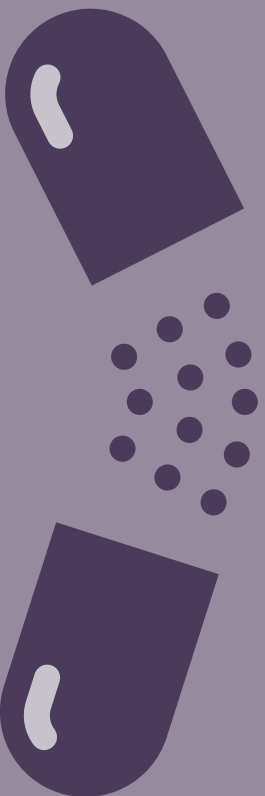
Resistance and inadequate treatment can lead to rapid **deterioration in the health of resistant patients**, lengthening hospital stays and saturating hospital capacity.



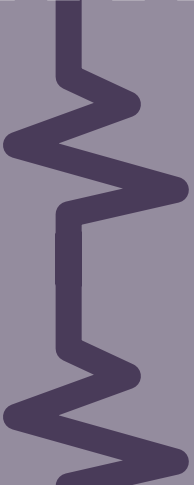
AN ENDANGERED HEALTHCARE SYSTEM



PRESSURE ON RESEARCH



ANTIBIOTIC RESISTANCE-RELATED DEATHS



POST-ANTIBIOTIC ERA: BACK TO 1920



GLOBAL RISK

In France, over 12,500 deaths a year are linked to infections caused by multidrug-resistant bacteria.

The limited diversity of available classes of antibiotics is conducive to the emergence of **treatment impasses**, which can be life-threatening.

Source: Dr. Jean CARLET and Pierre LE COZ. (2015). Proposals of the special working group for keeping antibiotics effective: Together, let's save antibiotics.



GLOBAL RISK

The WHO has declared antimicrobial resistance to be one of the major threats to global public health.

Overconsumption, misuse and the presence of antibiotics in our environment are the main causes. Without an appropriate response, **common infections and benign wounds could once again become fatal**, as they were before the era of antibiotics.



HEALTHCARE SYSTEM RISK

Faced with increasing resistance and the systematic use of last-resort treatments, **the healthcare system is in danger of exhausting its human, logistical and therapeutic capacities.**



GLOBAL RISK

Antibiotic resistance is a well-known phenomenon which is being studied. However, the **emergence of homogenized antibiotic resistance and multidrug resistance in the populations means that research and discovery of new, effective antibiotics is a complex, lengthy and costly process.**



MICROBIOTA RISK AND IMBALANCE



PERSONAL HEALTH RISK



PATIENT RISK



HEALTHCARE SYSTEM RISK



MICROBIOTA RISK



MICROBIOTA RISK



MICROBIOTA RISK



MICROBIOTA RISK



GLOBAL RISK



BACTERIAL INFECTION



ANTIBIOTIC TREATMENT



PATIENT RECOVERY



1

Bacterial infections occur when pathogenic bacteria enter the body and multiply.

BACTERIAL INFECTION

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1

When the immune system and/or treatment eliminate all of the pathogens, the **disease disappears**.

BACTERIAL INFECTION

BIOCODEX
Microbiota Institute



GLOBAL RISK



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Microbiota Institute



BACTERIAL INFECTION

1

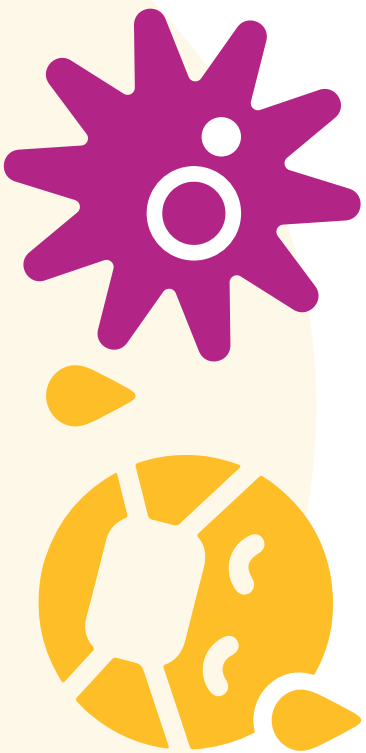
To eliminate the bacterial infection, **antibiotics** can be administered.

These antibiotics target the pathogenic bacteria, but can also disrupt the microbiota by affecting the commensal bacteria. Use of antibiotics can thus cause **dysbiosis**.

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VIRAL INFECTION



INEFFECTIVE ANTIBIOTIC TREATMENT



SELECTION OF RESISTANT BACTERIA



PATIENT RECOVERY



1^b

VIRAL INFECTION

Antibiotic treatments act on bacteria, not viruses.

1^b

VIRAL INFECTION

Certain events can lead to the introduction and multiplication of pathogenic viruses in our bodies, known as **viral infection**.



VIRAL INFECTION

When the immune system and/or treatment eliminate all of the pathogens, the **disease disappears**.

1^b

VIRAL INFECTION

Exposure to antibiotics can result in adaptation mechanisms, enabling bacteria to resist antibiotics. These are known as **resistant bacteria**.

The risk of developing resistance increases with the frequency and intensity of exposure to antibiotics, compromising their future efficacy.

This phenomenon is known as **antibiotic resistance**.



INFECTION BY RESISTANT BACTERIA



SELECTION OF MULTIDRUG- RESISTANT BACTERIA



1ST ANTIBIOTIC TREATMENT INEFFECTIVE, LEADING TO 2ND ANTIBIOTIC TREATMENT



PATIENT RECOVERY



A "first-line" antibiotic treatment may prove ineffective in the face of a resistant strain, requiring the introduction of **an alternative treatment.**



Some bacteria have genes that make them resistant to specific antibiotics.

It subsequently becomes necessary to use other molecules to ensure therapeutic efficacy.



When the immune system and/or treatment eliminate all of the pathogens, the **disease disappears.**



Multidrug-resistant bacteria (MDR or superbugs) possess resistance to several classes of antibiotics, making their infections very difficult to treat.

Multidrug resistance is a step towards a treatment impasse.



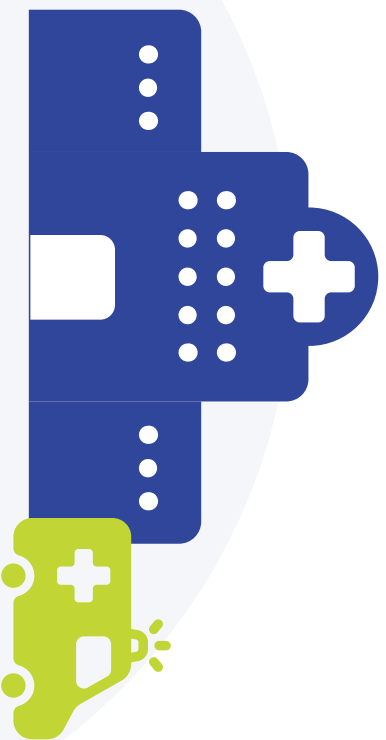
INFECTION BY RESISTANT BACTERIA



SEVERAL INEFFECTIVE ANTIBIOTIC TREATMENTS



HOSPITALIZATION



ADVANCED TREATMENT AND EXCEPTIONAL MEASURES TAKEN



A resistant bacterium can acquire resistance to several antibiotics, becoming multidrug-resistant.

Conventional treatment subsequently becomes very limited, if not impossible.



Some bacteria have genes that make them resistant to specific antibiotics.

It subsequently becomes necessary to use other molecules to ensure therapeutic efficacy.



For hospitalized patients, **more extensive treatments are required**, often accompanied by significant side effects and specialized hospital resources.



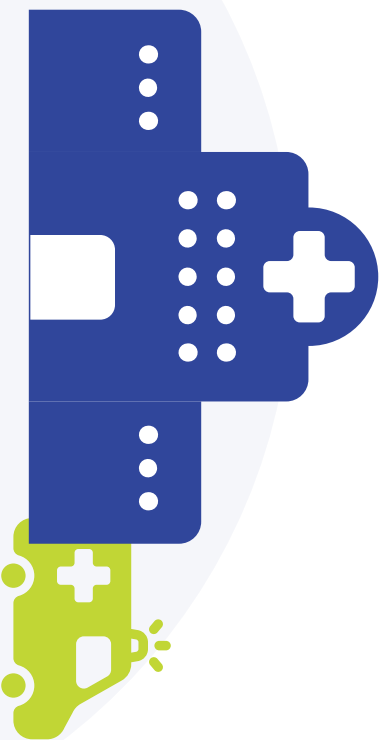
If there is no response to antibiotic treatment, the infection progresses and requires **hospitalization** to avoid systemic complications.



PATIENT RECOVERY



MEDICAL OR SURGICAL PROCEDURE



PRESCRIPTION OF PREVENTIVE ANTIBIOTIC TREATMENT DURING HOSPITALIZATION



POST-OPERATIVE COMPLICATIONS AND INFECTIONS

(Preventive antibiotic treatment ineffective)



3

PREVENTIVE ANTIBIOTIC TREATMENT

To prevent post-operative infections, **some patients may be given a course of antibiotics before medical or surgical procedures.**



3

Some preventive antibiotic treatments may turn out to be ineffective due to multidrug-resistant bacteria, leaving patients more vulnerable to **complications related to the procedure.**



2^b

INFECTION BY MULTI-DRUG RESISTANT BACTERIA

When the immune system and/or treatment eliminate all of the pathogens, the **disease disappears.**



3

PREVENTIVE ANTIBIOTIC TREATMENT

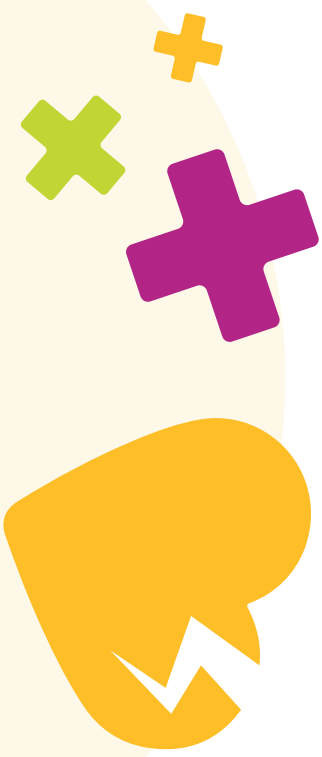
Any **surgical procedure** exposes the patient to the risk of infection. The use of antibiotics aims to reduce this risk.



IMPLEMENTATION OF EXCEPTIONAL MEASURES



PATIENT RECOVERY ?



LIVESTOCK FARMING



PHARMACEUTICAL INDUSTRY



In critical cases, **resistance to treatment can be life-threatening.**

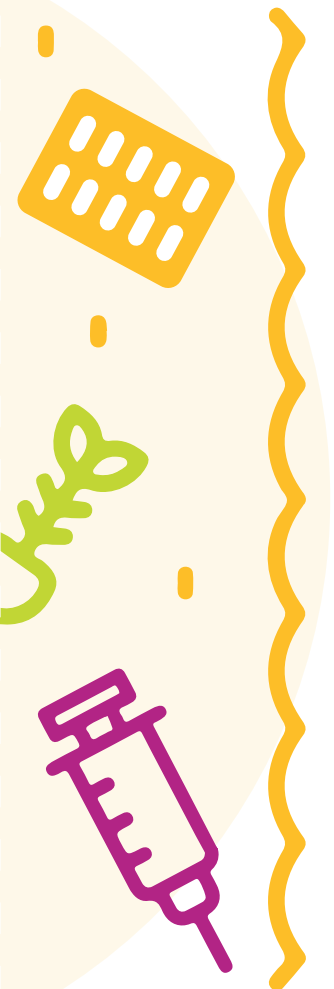
The use of significant medical resources is often necessary to deal with these resistant infections in patients.

The release of antibiotic residue in industrial wastewater, in connection with poorly-managed manufacturing processes, constitutes a major source of **water and soil contamination**, encouraging the **emergence of resistance in the environment.**

The widespread use of antibiotics in **livestock farming**, for preventive purposes or to promote growth, **contributes to the emergence of bacterial resistance.**

These bacteria can be transmitted to humans by ingestion, direct contact or via the environment (e.g. spreading of livestock slurry as fertilizer).

WATER AND SOIL POLLUTION



**PUBLIC HEALTH MESSAGING
ON BOXES AND LEAFLETS**



STAY IN SHAPE



**DEVELOP TARGETED,
MORE EFFECTIVE ANTIBIOTICS**



4

Physical activity improves overall fitness, stimulates the immune system and also promotes a balanced microbiota. A healthy lifestyle **reduces the risk of infection**.

Patient

Healthcare professional




In the absence of sufficiently stringent standards for wastewater treatment plants, **antibiotic residue remains in treated water**. Sludge from these facilities, like animal waste, is used as fertilizer on farmland, encouraging the spread of resistant bacteria that can be transmitted to humans.

Although the number of **antibacterial molecules in clinical development** has risen (from 80 in 2021 to 97 in 2023), investment in innovative agents, capable of treating serious infections and replacing agents that have become ineffective, remains crucial.

Patient

Healthcare professional




The inclusion of **messages about prevention** on drug packaging and leaflets would **promote the responsible use of antibiotics**.

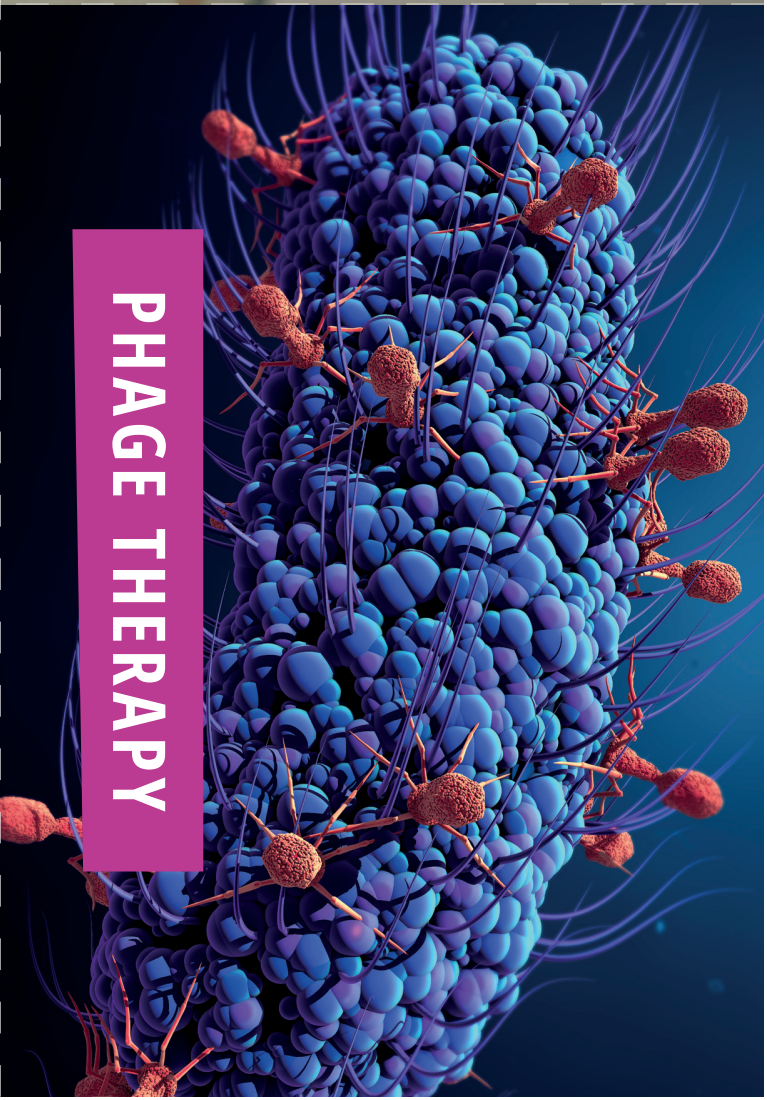
Patient

Healthcare professional

Source: World Health Organization (WHO). WHO releases report on state of development of antibacterials, [web page]: <https://www.who.int/news/item/14-06-2024-who-releases-report-on-state-of-development-of-antibacterials> [07/08/2025].



PUBLIC HEALTH CAMPAIGN ON ANTIMICROBIAL RESISTANCE (AMR)



PHAGE THERAPY



USE PROBIOTICS



PATIENT-SIDE PREVENTION

Phage therapy is a form of biological control. It is based on the **destruction of pathogenic bacteria by viruses** which are lethal to them, but incapable of infecting us.

These bacteria-specific viruses are called **bacteriophages**, also known as “phages.”

Patient

Healthcare professional

Campaigns to raise awareness need to be conducted in **public places** (schools, universities, nursing homes, town halls) and **healthcare environments** (waiting rooms, pharmacies) to inform the public about the risks associated with antibiotic resistance and to **encourage responsible behavior**.

Patient

Healthcare professional

Healthcare professionals must inform patients about the **risks of self-medication**, the need to **follow prescribed treatments** correctly, and the importance of **returning unused antibiotics**.

Patient

Healthcare professional

Probiotics promote a diverse and resilient microbiota, contributing to **better protection against infections**. In addition, the concomitant administration of yeast-type probiotics with antibiotic treatment helps limit microbiota imbalances, thus **reducing the risk of dysbiosis**.

Patient

Healthcare professional



**FACILITATE
PHARMACY TESTING**



DELIVER THE RIGHT DOSE



LIMIT PRESCRIPTIONS



**REVIEW ANTIBIOTIC
WASTE MANAGEMENT**

In countries that have **restricted the use of antibiotics** in human medicine and livestock farming, a **reduction in antibiotic resistance** has been observed.

For the prescriber, reasoned use of antibiotics means respecting clinical indications, and avoiding unjustified prescriptions, particularly in the case of viral infections. Preference should also be given to **narrow-spectrum antibiotics**, and **recommended dosages and treatment durations should be adhered to**.

Patient

Healthcare professional

Source: European Food Safety Authority (EFSA). Multi-agency report highlights importance of reducing antibiotic use [web page]: <https://www.efsa.europa.eu/en/news/multi-agency-report-highlights-importance-reducing-antibiotic-use> [07/08/2025]



Pharmacists can perform diagnostic tests (e.g. throat infections, cystitis) to differentiate between bacterial and viral infections.

This avoids unnecessary antibiotic prescriptions.

Patient

Healthcare professional



Optimizing the collection and sorting of medical waste would reduce the release of antibiotic residue into the environment and limit exposure to resistant bacteria.

Patient

Healthcare professional



Providing the exact quantity of tablets prescribed by the doctor helps avoid surplus drugs and limits the risk of inappropriate use.

Patient

Healthcare professional





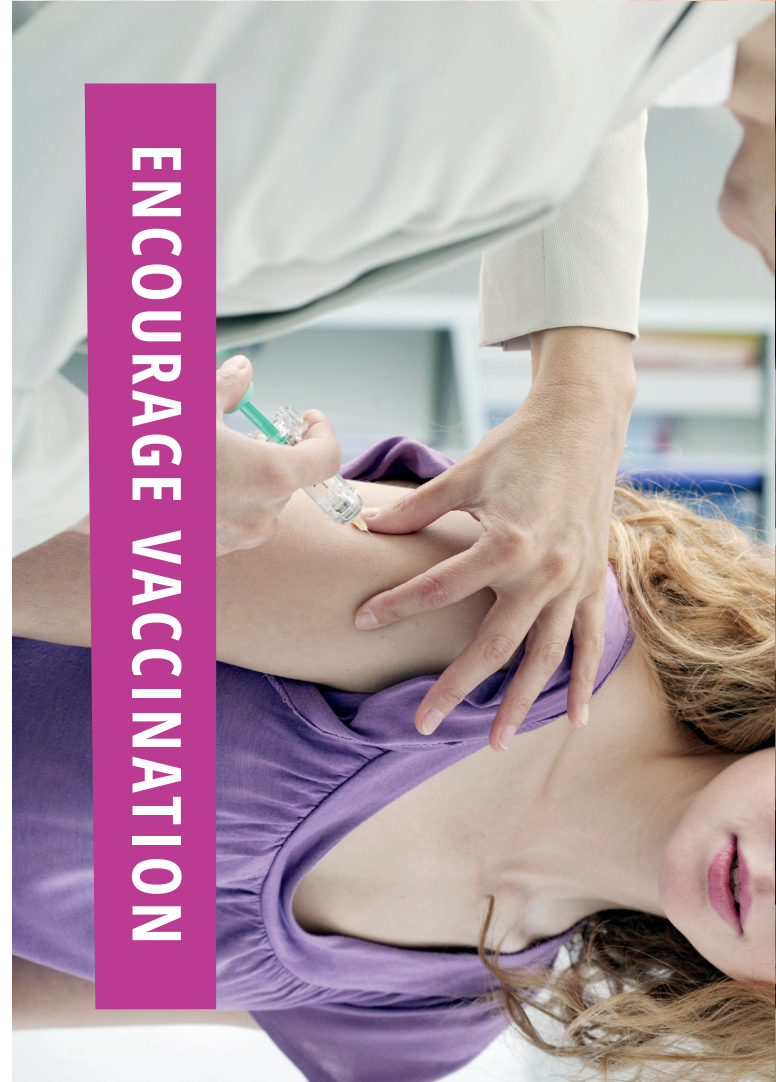
USE HYGIENE MEASURES



RAISE AWARENESS AMONG
THOSE AROUND YOU



HAVE A HEALTHY DIET



ENCOURAGE VACCINATION

To take effective action against antibiotic resistance, it is essential to understand what is at stake.

In addition to this understanding, **passing on best practices** increases awareness and encourages action. Spreading these messages to those around you—to your family, colleagues or patients—is a practical first step.

Patient

Healthcare professional

Hygiene measures help limit the transmission of infectious agents, thereby reducing the need for antimicrobials.

Patient

Healthcare professional

Vaccination can prevent many infections, thus reducing the need for antimicrobials. **Vaccination against certain bacterial infections reduces the need for antibiotics**, thus preserving the balance of the gut microbiota.

For example, the pneumococcal vaccine has considerably reduced antibiotic resistance in this bacterial species.

Patient

Healthcare professional

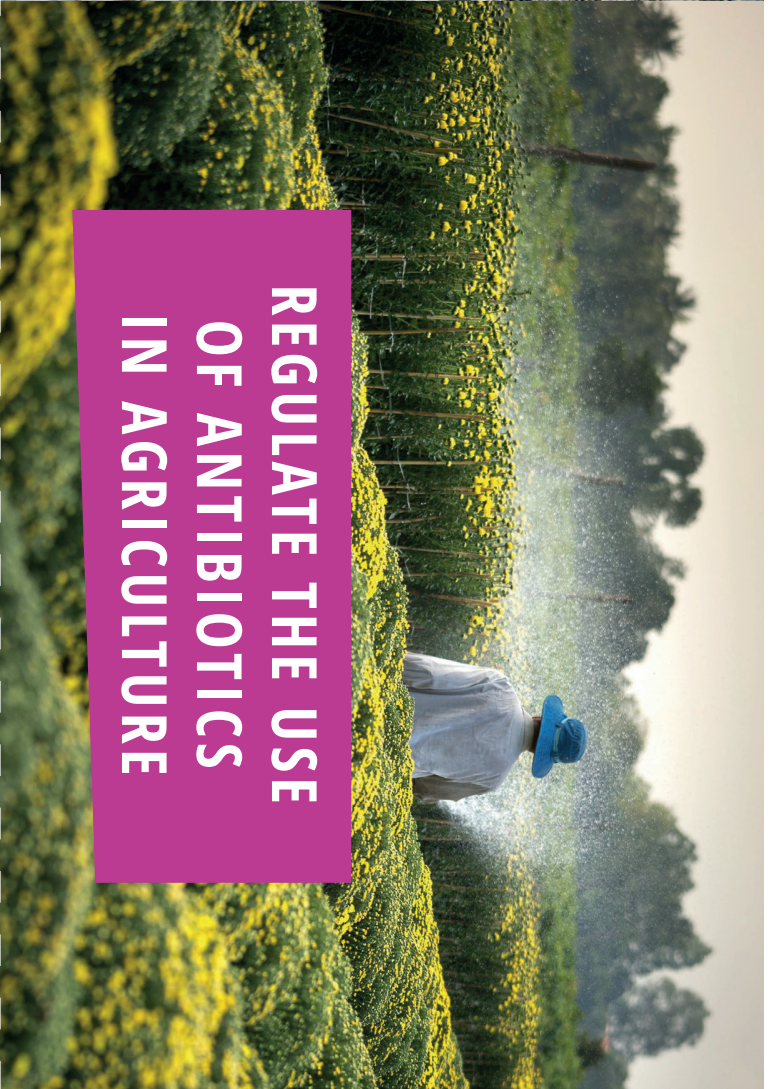
A balanced (healthy and varied), unprocessed diet promotes a diverse and balanced gut microbiota, essential for **boosting immune defenses** and **limiting infections**.

Patient

Healthcare professional



**RETURN MEDICINES
TO THE PHARMACY**



**REGULATE THE USE
OF ANTIBIOTICS
IN AGRICULTURE**



FUND RESEARCH



**ADOPT A ONE HEALTH
APPROACH**

The use of antibiotics to promote growth has been banned in the European Union since 2006.

For global effectiveness, **these regulations need to be extended internationally.**

Patient

Healthcare professional

Returning unused medicines to the pharmacy helps prevent self-medication, dosage errors and environmental pollution.

Patient

Healthcare professional

The One Health concept promotes an integrated vision of health, considering the interactions between humans, animals and the environment, at all levels (local, national and global).

This systemic approach makes it possible to design coherent policies that simultaneously **address health and environmental issues.**

Patient

Healthcare professional

The development of new antibiotics is essential to treat infections caused by priority pathogens, according to the WHO.

However, without a review of prescribing practices, these new molecules run the risk of rapidly becoming ineffective.

We also need to **support research into alternative treatments**, such as phage therapy, which uses specific viruses (phages) to eliminate bacteria.

Patient

Healthcare professional