Tristel™

THE FIGHT AGAINST ANTIMICROBIAL RESISTANCE:

Disinfect Responsibly

Antimicrobial resistance (AMR) is a global public health issue. In 2019, it directly caused more than 1.27 million deaths and contributed to 4.95 million others. In addition to its impact on human health, AMR also has a significant economic impact. Without concrete actions, the costs related to healthcare and productivity losses could reach up to $1 trillion by 2050.

Global Impact of AMR

Situation in 2019

Directly caused **1.27 million** deaths.

Is associated with nearly **5 million** deaths.

Forecast for 2050

According to the World Health Organization, it could lead to up to **10 million** deaths per year.

According to the World Bank Group, it could result in an additional cost of **$1 trillion** for healthcare systems.

Our Society is Facing an Emergency: Avoiding the Post-Antibiotic Era

Without concrete action, we risk entering a "post-antibiotic" era in which common infections will become impossible to treat.

Inappropriate use of antimicrobials → Bacteria develop resistance → Antimicrobials are becoming less effective → Diseases spread more easily → A post-antibiotic era where infections are increasingly difficult to treat

Causes of Antimicrobial Resistance

Over-Prescription and Inappropriate Use of Antibiotics

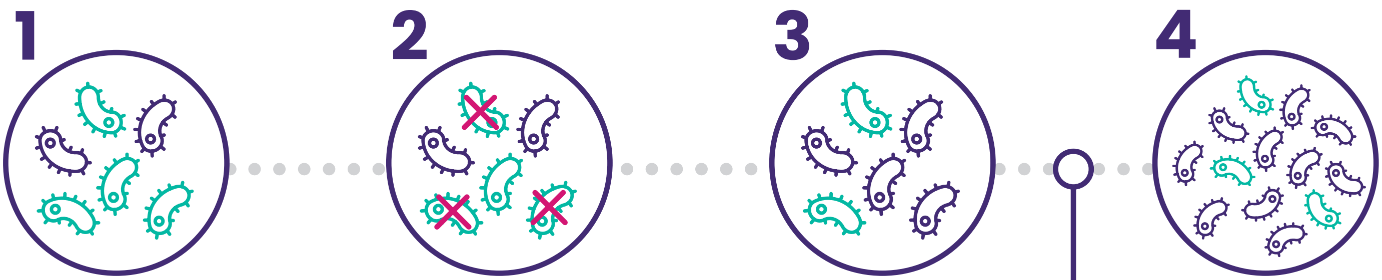
The more frequently and excessively these antibiotics are used, the greater the risk of resistant bacteria developing. Not to mention that incorrect use of antibiotics, such as prematurely interrupting treatment, allows bacteria to survive and develop resistance.

Use of Certain Biocides for Surface Disinfection, in Particular Quaternary Ammonium Compounds (QACs)

QACs are positively charged surfactants **effective against a limited spectrum of micro-organisms** (mainly bacteria, yeasts and enveloped viruses), which act by binding to their cell membrane. After a certain time, this wall can be penetrated, leading to a rupture of the membrane and leakage of its contents.

In simple terms, QACs **work their way inside micro-organisms to cause their death.**

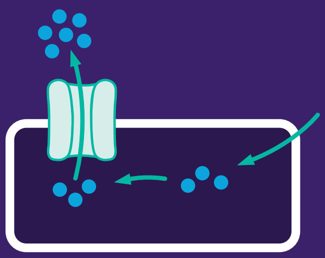
This disruption does not occur **immediately or at every concentration**. In many cases, it only occurs when high concentrations of QACs or combinations of QACs are used. In all other cases, QACs can interact with micro-organisms, but not to the point of causing their death.



1. Bacteria are present on a surface
2. **QACs**, in sublethal dose, are used to eliminate them
3. **QACs** interact with tolerant bacteria without necessarily causing their death
4. Tolerant bacteria survive and multiply

It is in this grey area that AMR becomes a real threat that needs to be closely monitored.

Resistance Mechanisms



Development of Acquired Bacterial Resistance

Bacteria can manifest structures called **efflux pumps**, enabling the cells to regulate their internal environment by **actively eliminating disinfecting agents that enter the cell.** This reduces their toxic effect and helps micro-organisms to survive in an environment containing sublethal doses of disinfectants.

This acquired bacterial resistance is not limited to a single micro-organism. **Bacteria that have learned to defend themselves will pass on their resistance gene** to their offspring or congeners through simple contact with other micro-organisms of the same or different species.

Co-Resistance or Cross-Resistance Between Disinfectants and Antibiotics

A micro-organism that has acquired resistance to a particular disinfectant agent may also use similar mechanisms to resist other antimicrobials, including antibiotics. This is referred to as **co-** or **cross-resistance**.

The disinfectants that protected us to a certain extent in the past could well endanger our health system by promoting AMR.

It is not appropriate to manage an infectious risk considered to be “low” with a low-level disinfectant, as this leaves the door open to resistance.

Preventing Antimicrobial Resistance

Limiting Sub-Inhibitory Doses of Antimicrobials

Low dosage will destroy some micro-organisms, but those that survive will be less sensitive to the antimicrobials used. Disinfectant solutions with variable dilutions are particularly problematic. They do not allow users to be certain that they have chosen the right concentration.

Avoiding Biocides with Variable and Prolonged Contact Times

A biocide with a long contact time and a low reactivity exposes micro-organisms to sublethal concentrations. This encourages the survival of infectious micro-organisms whose susceptibility to antimicrobials is reduced.

Tristel ClO_2: A Chemistry to Surmount Antimicrobial Resistance

Turn to High-Level and Sporicidal Disinfectants That Do Not Present a Risk of Resistance

Effective

Tristel ClO_2 is an effective biocide against bacteria, viruses, protozoa, yeasts, fungi, mycobacteria and bacterial spores.

No Variation - a Single Contact Time, a Single Solution

The ability of Tristel ClO_2 to **kill a full spectrum** of micro-organisms is well established, without the need for concentration adjustment by users and without variable or prolonged contact times. **Efficacy against micro-organisms is almost immediate** (between 30 seconds and 5 minutes depending on the product) and is achieved at **a single concentration rate** (between 100ppm and 200ppm depending on the product).

No Risk of Antimicrobial Resistance

Daily use of Tristel ClO_2 does not contribute to AMR. In addition to its full spectrum of efficacy in a short, uniform contact time and at a single concentration rate, the biocidal activity of Tristel ClO_2 is distinguished by **its mode of action, oxidation**.

Tristel ClO_2 is an oxidant that **kills pathogens by exchanging electrons**, sequestering them from the micro-organism's vital structures such as cell walls, membranes, organelles and genetic material. It is this exchange that **causes a molecular imbalance, leading to the certain death of the micro-organisms**.

Unlike QACs, which only manage to eliminate them under certain conditions, Tristel ClO_2 always destroys them, even with repeated use.

Antimicrobial resistance is a crucial challenge, but action can be taken to prevent it. **By using antimicrobials responsibly, we can combat this public health concern.**

Tristel™

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