# SESSION 6:ANTIMICROBIAL RESISTANCE AS A CONSEQUENCE OF WAR

Moderated by Ms. Olga Gvozdetska,Acting Deputy Director, Public Health Center of the Ministry of Health of Ukraine

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# ANTIMICROBIAL RESISTANCE IN UKRAINE: CHALLENGES OF WAR

Roman Kolesnyk,
Head of the AMR and IPC department Public Health Center of MOH of Ukraine

PUBLIC HEALTH CENTER

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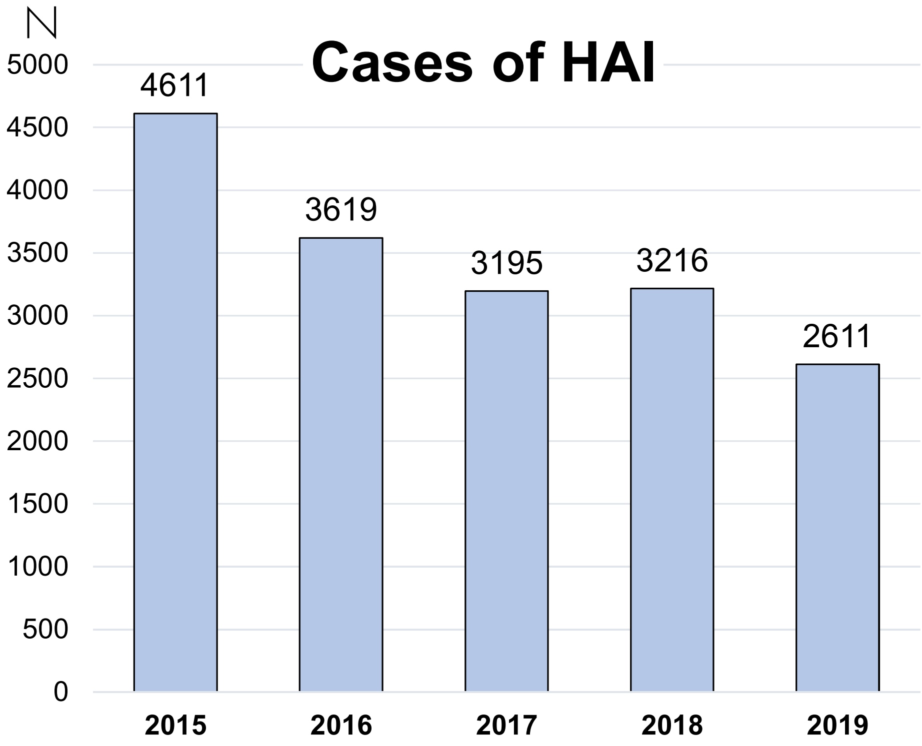
# Detection of healthcare-associated infections in hospitals of Ukraine

- Prevalence of HAI – 0,035 %




## Results of HAI **PPS** and antibiotics consumption - **2021**

| Indicator | Value |
|---|---|
| Prevalence of HAI, % | **5,7** |
| 95% confidence interval for the prevalence of HAI | **(4,5)–(6,9)** |
| Prevalence of antibiotics consumption, % | **36,9** |
| 95% confidence interval for the antibiotics consumption | **(34,4)–(39,5)** |

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Results of the monitoring of AM consumption in health care facilities, in compliance with order of the MOH of Ukraine August 03, 2021 No. 1614

Overconsumption

**AWaRe WHO**
- Access
- Watch
- Reserve

* - INN, which ones **do not have** a registration certificate in Ukraine

| INN | Share of consumption from the total,% |
|---|---|
| Ceftriaxone | 38.5989 |
| Levofloxacin | 32.6120 |
| Linezolid | 7.1149 |
| Moxifloxacin | 6.5299 |
| Ciprofloxacin | 5.5437 |
| Meropenem | 3.3724 |
| Cefazolin | 1.9067 |
| Cefuroxime | 1.7404 |
| Kolistyn | 1.3788 |
| Ceftazidime-avibactam | 0.4598 |
| Meropenem-vaborbactam * | **0.4564** |
| Daptomycin | 0.1346 |
| Tigecycline | 0.0937 |
| Fosfomycin (in/in) | 0.0236 |
| Dalbavancin * | 0.0064 |
| Polymyxin B | 0.0059 |
| Tedizolid * | 0.0050 |
| Ceftolozan-tazobactam | 0.0041 |
| Aztreonam | 0.0033 |
| Plazomicin * | 0.0022 |
| Minocycline * | 0.0022 |
| Telavancin * | 0.0018 |
| Ceftaroline fosamil * | 0.0015 |
| Faropenem * | 0.0013 |
| Omadacycline * | 0.0004 |
| Eravacycline * | 0.0001 |

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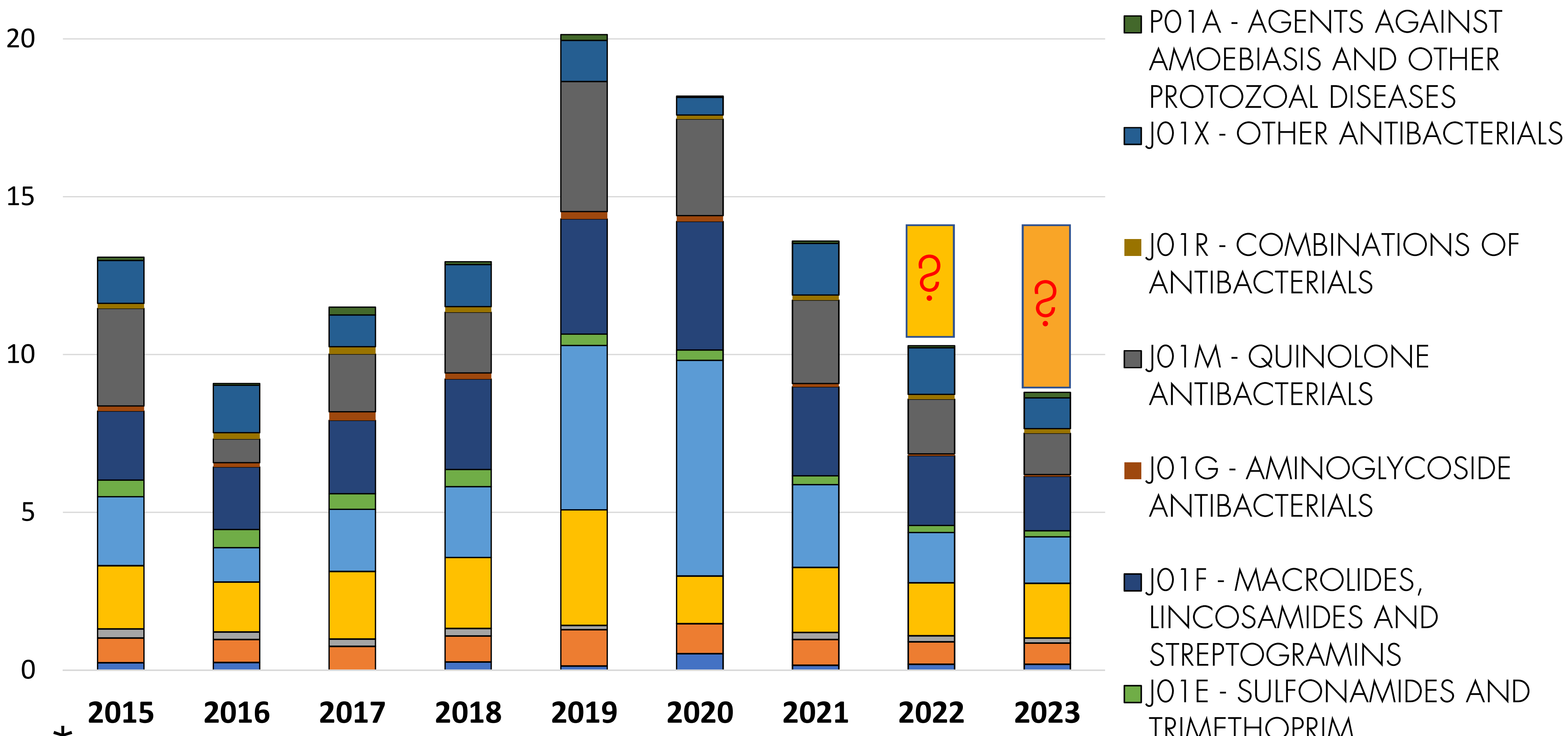
# Consumption of antibacterials (DDD per 1000 inhabitants per day) by pharmacological subgroup (ATC3 level)*




* Data were processed according to the methodology of WHO GLASS-AMC

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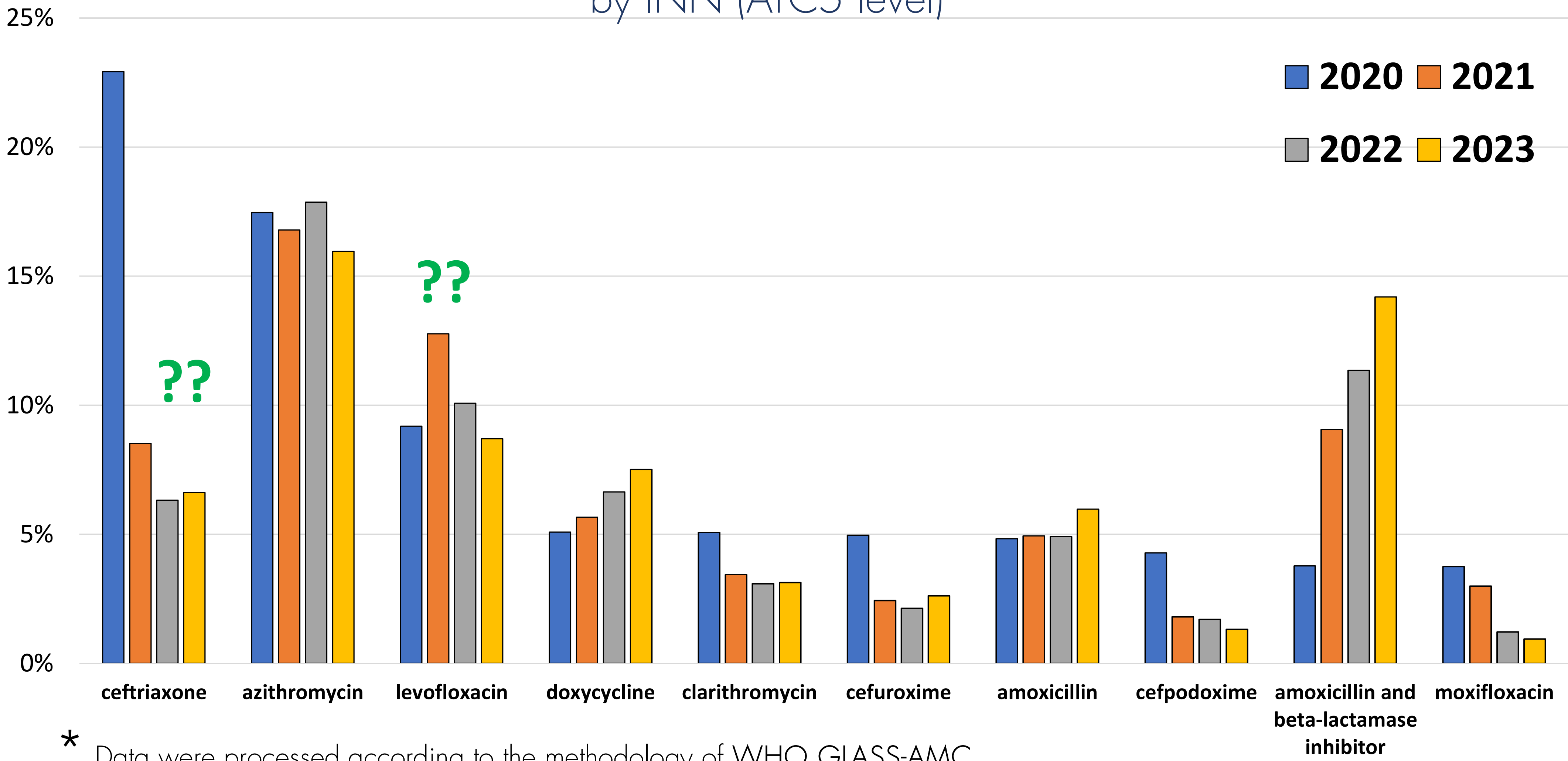
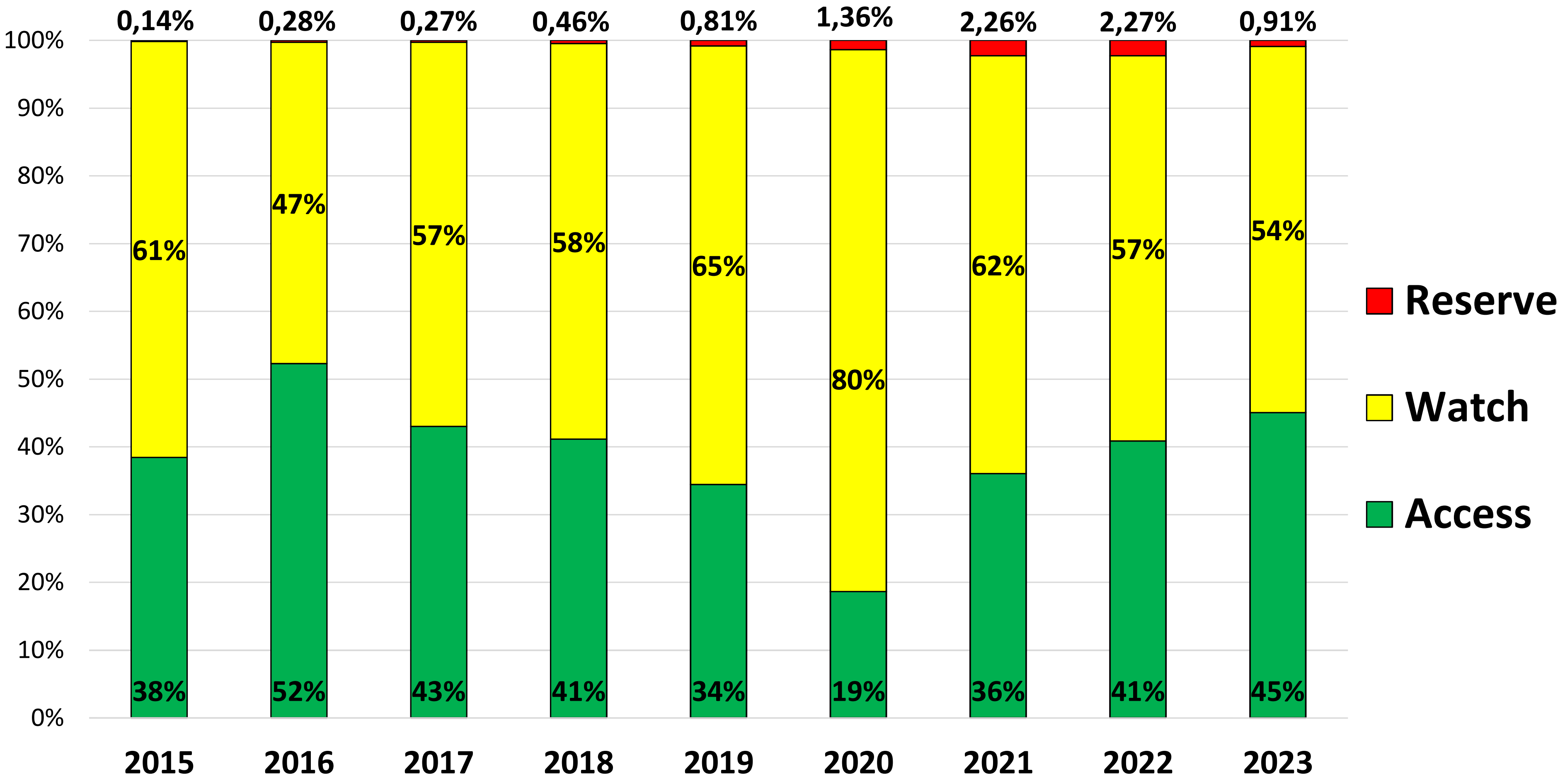
# Consumption of antibacterials (DDD per 1000 inhabitants per day) by INN (ATC5 level)*




* Data were processed according to the methodology of WHO GLASS-AMC

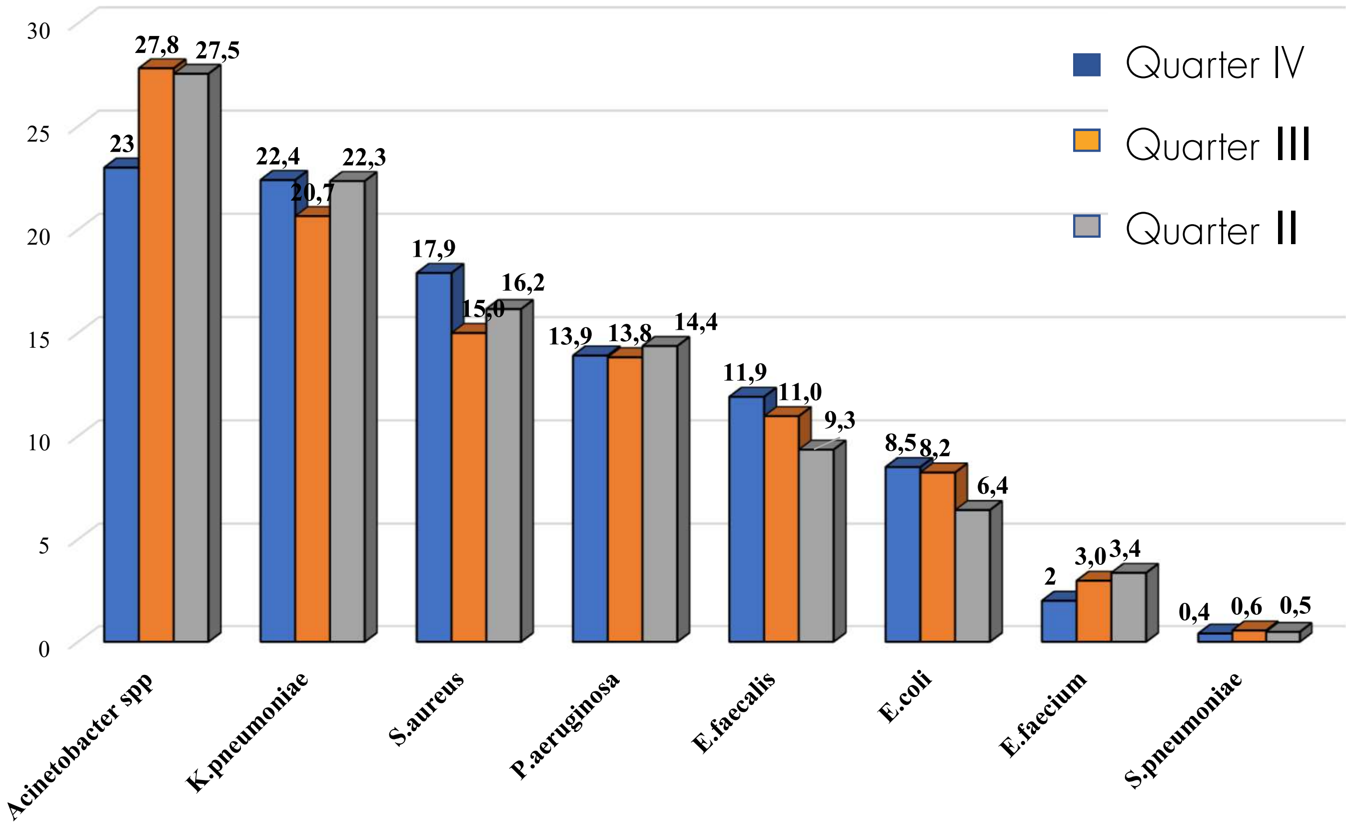
# Consumption by AWaRe categories*




* Data were processed according to the methodology of WHO GLASS-AMC

# The frequency of pathogen strains detection in hospitals of Ukraine during the treatment of war wounded

- **24,584** wound samples were studied
- **18,966** samples were positive
- Of them, **10,200** (53,7%) are strains identified for surveillance - ESKAPE



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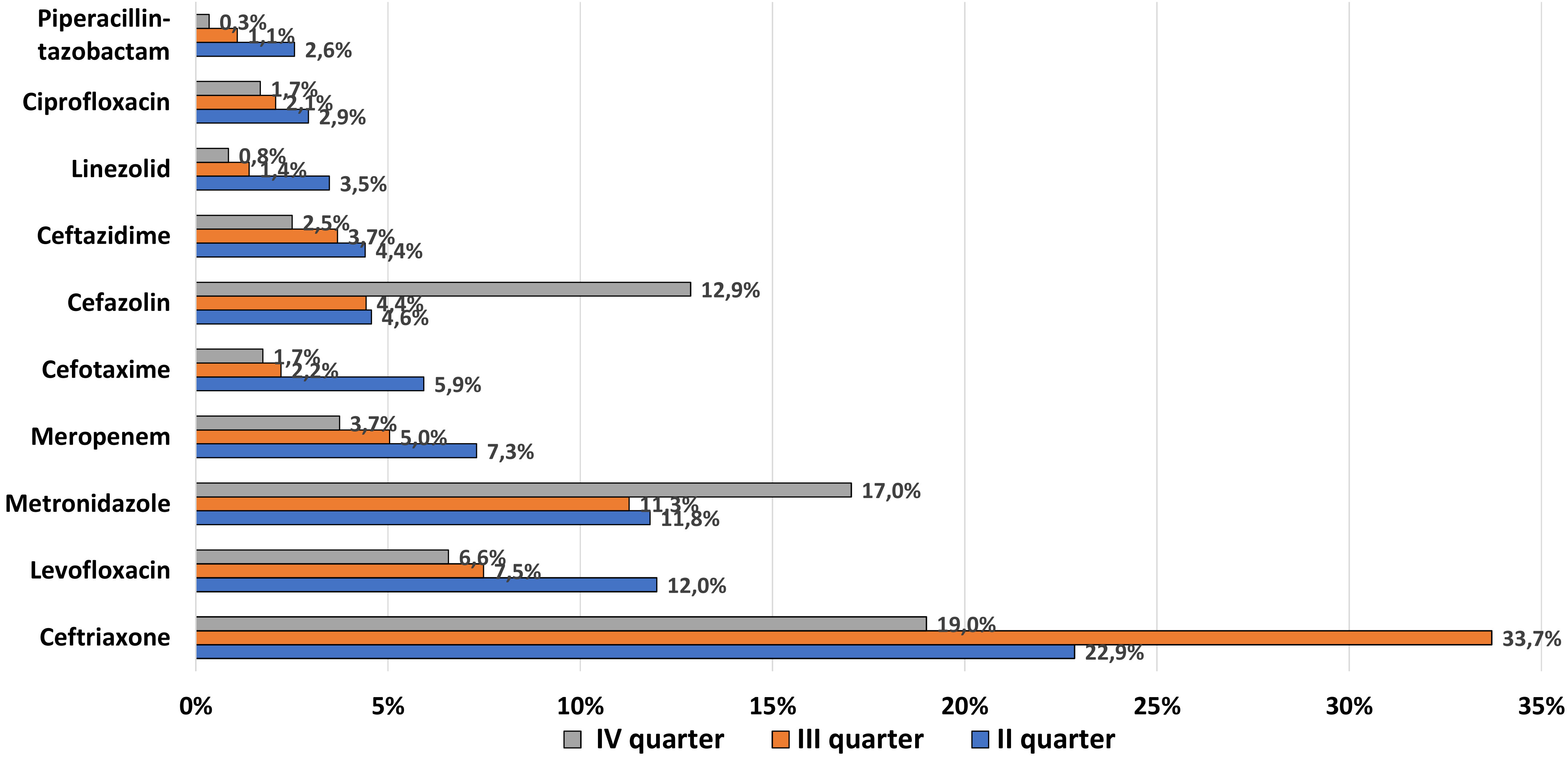
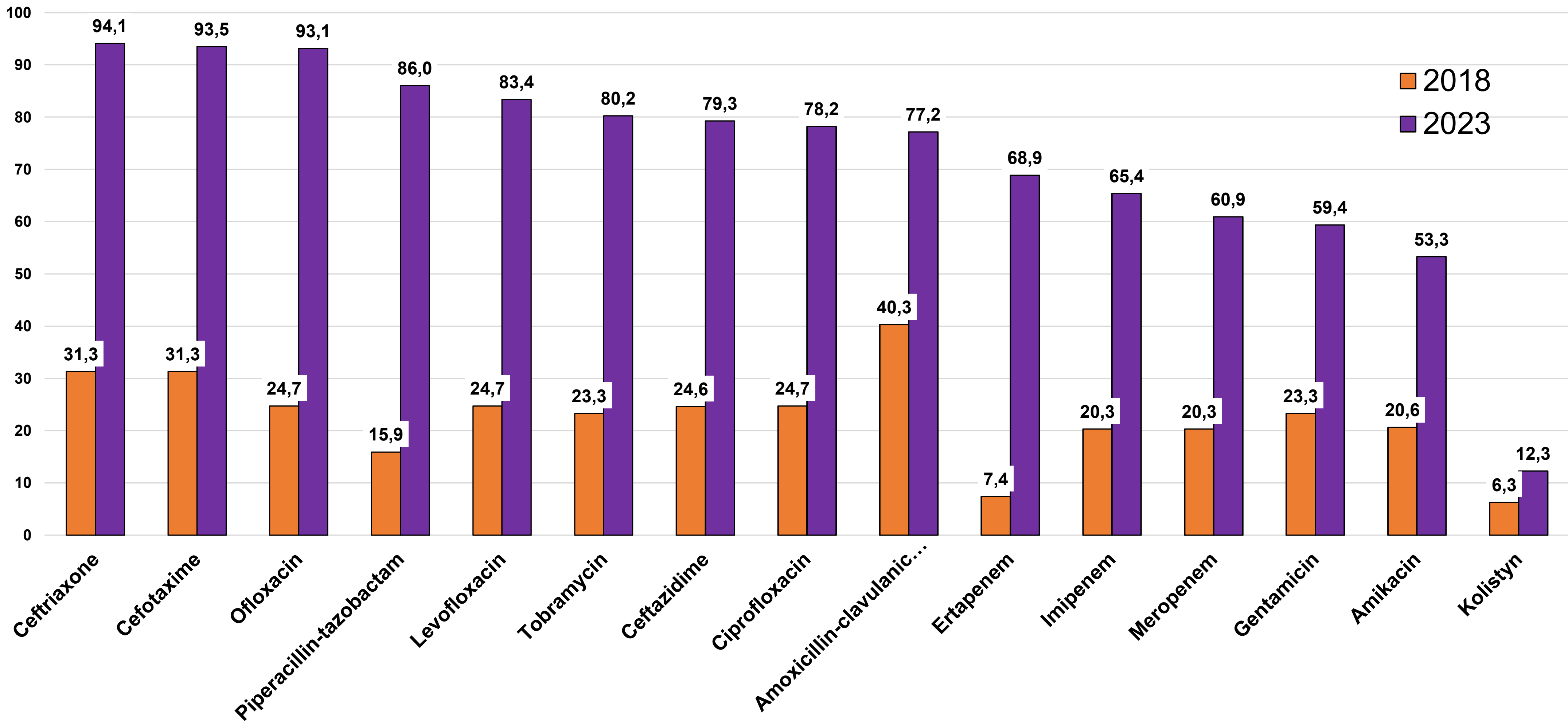
# The frequency of antibiotics consumption for the treatment of war wounded 2023 y



# Prevalence of *K. pneumoniae* strains resistant to antibiotics, %



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# Strategic goals of the fight against AMR until 2030 year

- Strengthening the system of infection prevention control in health care institutions;
- Increasing the capacity of bacteriological laboratories
- Implementation of a surveillance system for pathogens with AMR and consumption of antimicrobials;
- Strengthening of measures to ensure the welfare of animals, veterinary-sanitary and epizootic welfare in terms of countering the spread of pathogens with AMR;
- Raising the awareness of the population, medical and veterinary workers regarding the prevention of infection and countering the spread of AMR pathogens;
- Strengthening of personnel potential and conducting scientific research.

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Dr. Danilo Lo Fo Wong,
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WHO EURO

# WHO'S COLLABORATIVE APPROACH FOR UKRAINE AND MITIGATING EUROPEAN SPREAD

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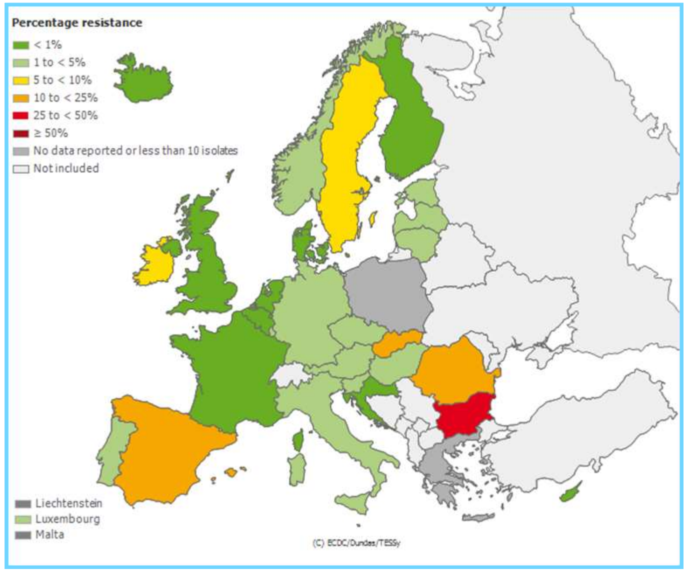
World Health Organization
European Region

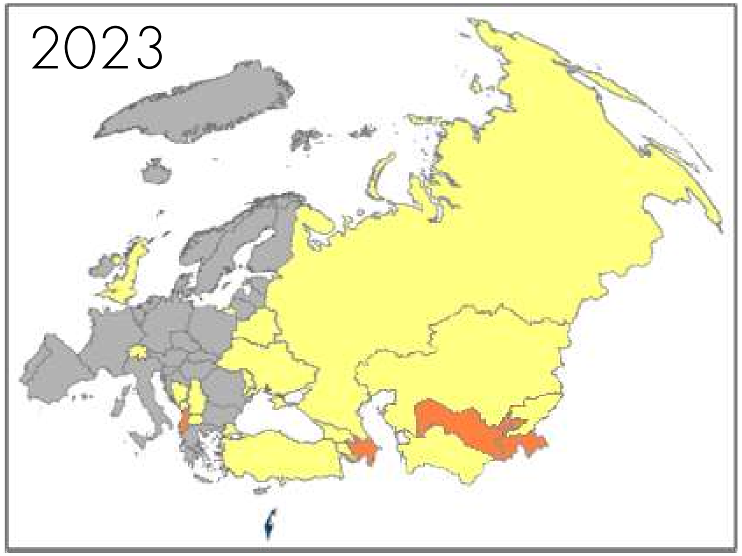
# Expanding AMR surveillance throughout Europe

## European Antimicrobial Resistance Surveillance Network (EARS-Net)




European Centre for Disease Prevention and Control

## Central Asian and European Surveillance of AMR (CAESAR)




World Health Organization European Region

- Countries submitting data to CAESAR
- Countries building capacity for CAESAR participation
- Countries invited for CAESAR participation
- Countries participating in EARS-Net

# AMR Surveillance Network Ukraine



2024 – over 100 (TBC)

2023 – 80 laboratories (73 reported in 2024)

2022 – **67** laboratories (**22** regions)

2021 – **28** laboratories (**14** regions)

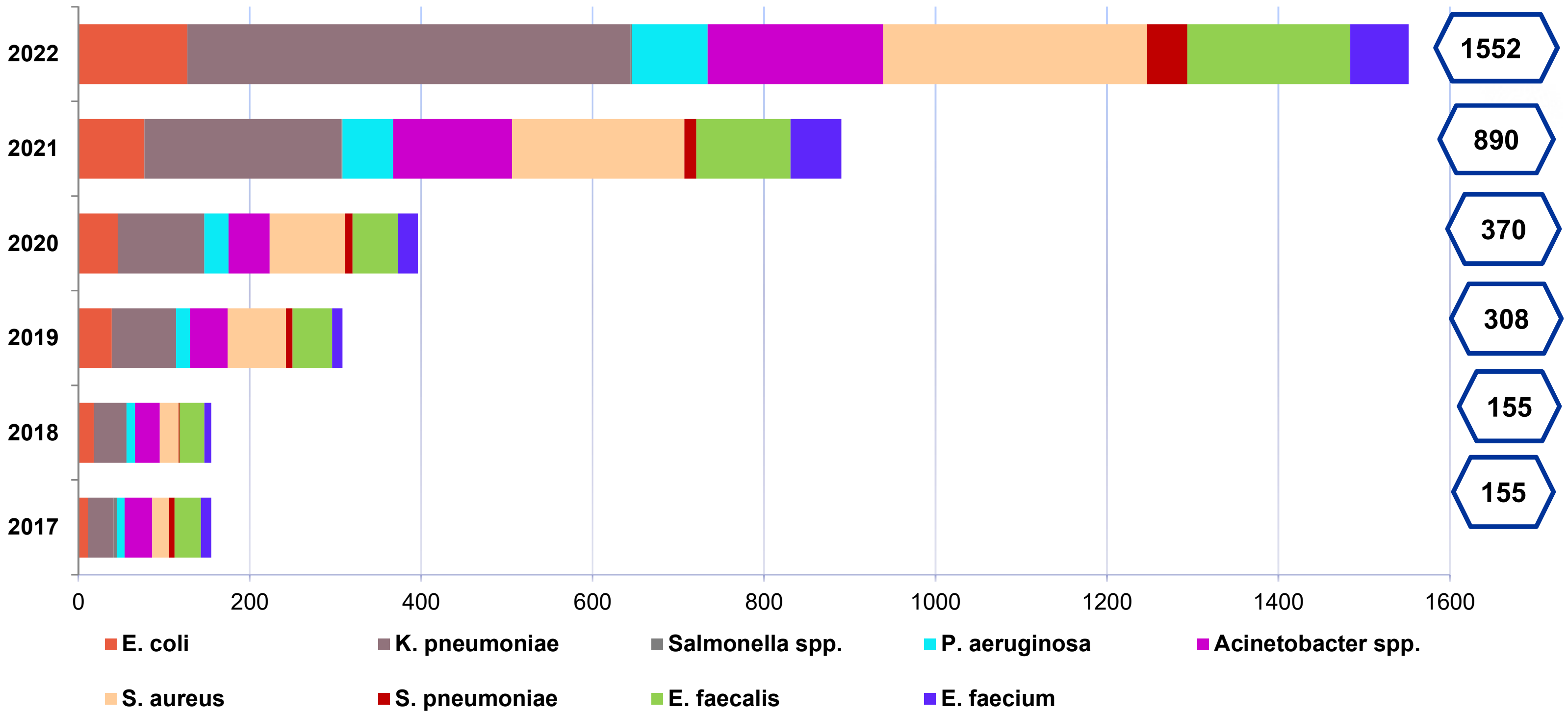
**2020 – 9** laboratories

**2019** – 7 laboratories

**2018** – 5 laboratories

**2017** – the beginning of work – **4** laboratories (**3** regions)

# Ukraine`s reporting to CAESAR 2017-2022



# Capacity building
# - EUCAST implementation training -

- Seven 3-days trainings on EUCAST methodology implementation and AST (over 200 participants; 22 regions);
- Quarterly online webinars dedicated to current issues in clinical microbiology

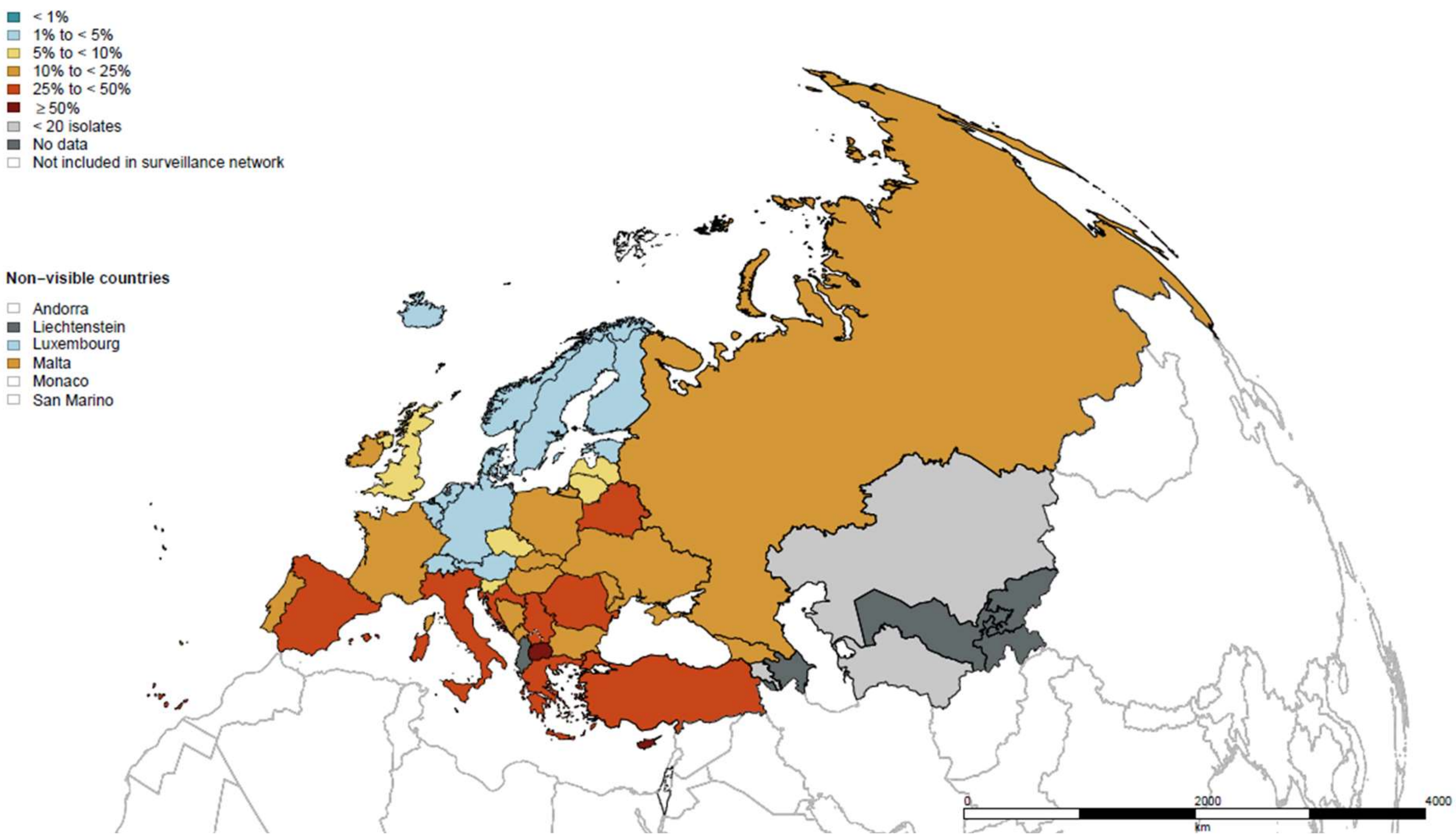
# Surveillance network development

- First National meeting of AMR surveillance Network
  (46 healthcare institutions, representing 19 regions)
- Second National meeting of AMR surveillance Network  (21st May; over 80 laboratories)

# Expanding AMR surveillance through the European region

World Health Organization
European Region

**Fig. 8. *Staphylococcus aureus*: percentage of invasive isolates resistant to methicillin (MRSA)[a], by country, WHO European Region, 2022**



# The need to strengthen AMR surveillance in EURO

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## First detection in Spain of NDM-1-producing *Pseudomonas aeruginosa* in two patients transferred from Ukraine to a university hospital

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A R T I C L E I N F O

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Ukraine
Whole genome sequencing

A B S T R A C T

*Objectives:* Carbapenemase-mediated carbapenem resistance in *Pseudomonas aeruginosa* is a relevant health problem. We detected for the first time in Spain two clinical NDM-producing *P. aeruginosa* (NDM-Pa) isolates in two Ukrainian patients admitted to our hospital between April and August 2022.
*Methods:* Antimicrobial susceptibility was studied by microdilution and MIC gradient strips (EUCAST-2022 criteria). Carbapenemase genes were detected by the Xpert Carba-R and immunochromatography assays. WGS (Illumina and Oxford-Nanopore) was also performed.
*Results:* In May 2022, we detected an NDM-Pa in a sternotomy wound in a patient. In June-2022, a second NDM-Pa along with an OXA-48-*Klebsiella pneumoniae* (OXA-48-Kp) isolate was detected in a mandibular abscess from an unrelated patient. Moreover, an NDM+OXA-48-*K. pneumoniae* (NDM+OXA-48-Kp) was also found in a rectal sample of this patient. Both patients had undergone surgery in Ukraine before their transfer to our hospital. NDM-Pa isolates were resistant to all tested antimicrobials with the exception of aztreonam (MIC = 8 mg/L), colistin (MIC =2 mg/L) and cefiderocol (MIC range = 0.75–2 mg/L). WGS confirmed that both *P. aeruginosa* isolates were NDM-1 producers, belonged to ST773 and shared an identical resistome. $bla_{NDM-1}$ was located on a ~117-Kb chromosomally integrated integrative conjugative element (ICE). OXA-48-Kp and NDM+OXA-48-Kp belonged to ST147 and contained $bla_{OXA-48}$ on an identical ~300-Kb IncHIB-plasmid. $bla_{NDM-1}$ was located on a 51-Kb IncFIB-plasmid only found in NDM+OXA-48-Kp.
*Conclusions:* This is the first description of NDM-Pa in Spain. We highlight the threat of further cross-border dissemination of NDM-1 through *P. aeruginosa* along with *K. pneumoniae* high-risk clones also carrying OXA-48, which draws a complex epidemiological scenario.



### 1. Introduction

Multidrug-resistant or extensively drug-resistance (MDR/XDR)-*Pseudomonas aeruginosa* is associated with difficult-to-treat hospital-acquired infections and high rates of morbimortality, particularly in immunocompromised patients. The global spread of carbapenem-resistant *P. aeruginosa*, frequently belonging to epidemic high-risk clones widely disseminated in hospital setting, has become a public health threat [1,2]. The major mechanisms of carbapenem resistance in *P. aeruginosa* are overexpression of the MexAB-OprM efflux pump, overproduction of AmpC β-lactamase and inactivation of the outer membrane protein OprD, and the least common production of carbapenemases [2,3]. *P. aeruginosa* isolates have been described to contain a wide variety of carbapenemases, mostly VIM and IMP metallo-β-lactamases, and less frequently, depending on the geographic area, NDM metallo-β-lactamase, KPC and GES class A serin-carbapenemases and OXA-48-*like* oxacillinases [3,4].

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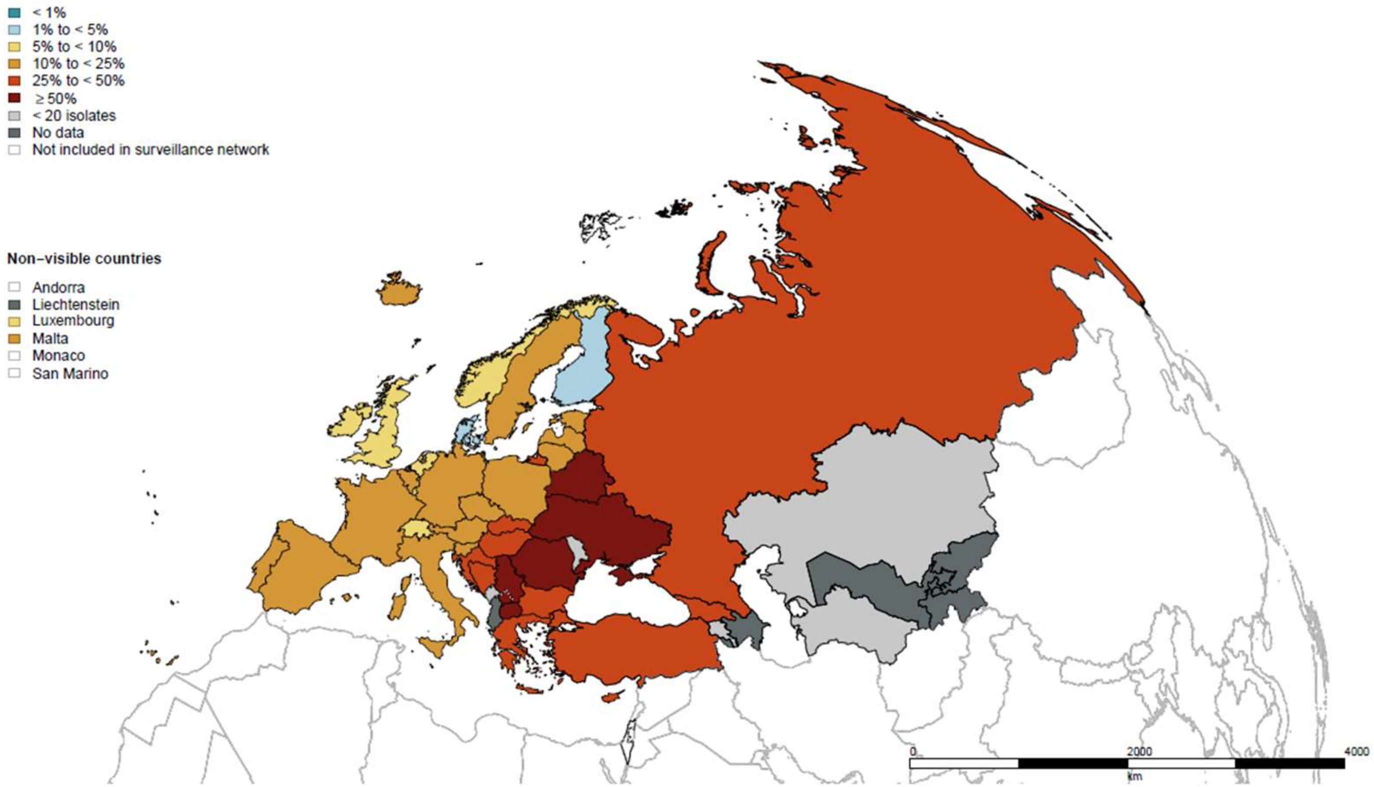
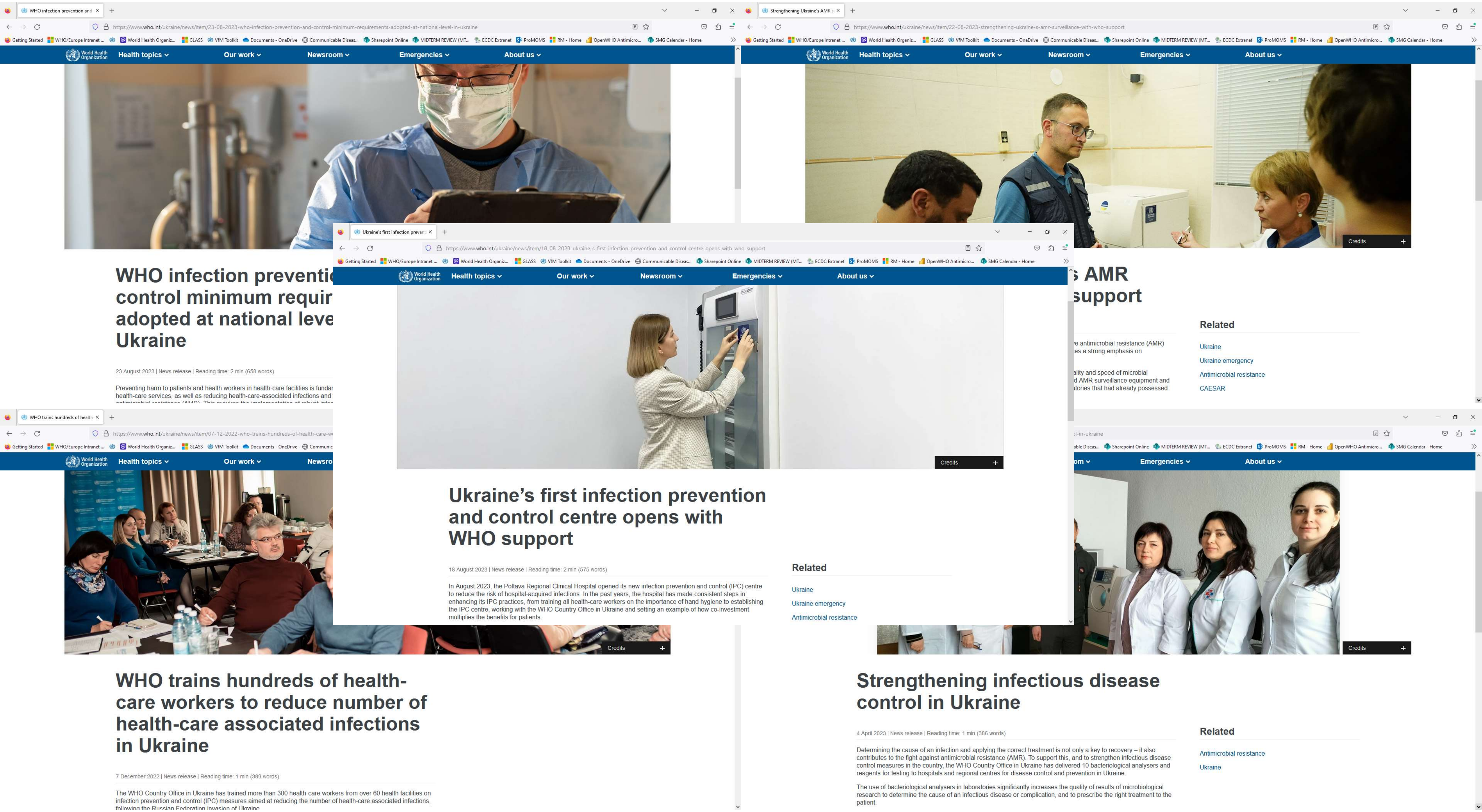
https://doi.org/10.1016/j.jgar.2023.12.022


**Fig. 6.** ***Pseudomonas aeruginosa*: percentage of invasive isolates resisant to carbapenems (imipenem/meropenem), by country, WHO European Region, 2022**





# WHO infection preventi[on and] control minimum requir[ements] adopted at national leve[l in] Ukraine

23 August 2023 | News release | Reading time: 2 min (658 words)

Preventing harm to patients and health workers in health-care facilities is fundar[...] health-care services, as well as reducing health-care-associated infections and [...]

# [...]s AMR [...] support

Related

Ukraine

Ukraine emergency

Antimicrobial resistance

CAESAR

[...]e antimicrobial resistance (AMR) [...]es a strong emphasis on [...]

[...]ality and speed of microbial [...]d AMR surveillance equipment and [...]atories that had already possessed

# Ukraine's first infection prevention and control centre opens with WHO support

18 August 2023 | News release | Reading time: 2 min (575 words)

In August 2023, the Poltava Regional Clinical Hospital opened its new infection prevention and control (IPC) centre to reduce the risk of hospital-acquired infections. In the past years, the hospital has made consistent steps in enhancing its IPC practices, from training all health-care workers on the importance of hand hygiene to establishing the IPC centre, working with the WHO Country Office in Ukraine and setting an example of how co-investment multiplies the benefits for patients.

Related

Ukraine

Ukraine emergency

Antimicrobial resistance

# WHO trains hundreds of health-care workers to reduce number of health-care associated infections in Ukraine

7 December 2022 | News release | Reading time: 1 min (389 words)

The WHO Country Office in Ukraine has trained more than 300 health-care workers from over 60 health facilities on infection prevention and control (IPC) measures aimed at reducing the number of health-care associated infections, following the Russian Federation invasion of Ukraine.

# Strengthening infectious disease control in Ukraine

4 April 2023 | News release | Reading time: 1 min (386 words)

Determining the cause of an infection and applying the correct treatment is not only a key to recovery – it also contributes to the fight against antimicrobial resistance (AMR). To support this, and to strengthen infectious disease control measures in the country, the WHO Country Office in Ukraine has delivered 10 bacteriological analysers and reagents for testing to hospitals and regional centres for disease control and prevention in Ukraine.

The use of bacteriological analysers in laboratories significantly increases the quality of results of microbiological research to determine the cause of an infectious disease or complication, and to prescribe the right treatment to the patient.

Related

Antimicrobial resistance

Ukraine

# Main challenges

"Since February 2022, WHO has documented 1552 attacks on health, impacting health providers, supplies, facilities, warehouses and transport, including ambulances. They have claimed at least 112 lives, including health-care workers and patients, and injured many more".

https://www.who.int/europe/news/item/07-02-2024-ukraine-witnessing-increasing-impact-of-attacks-on-health-and-education

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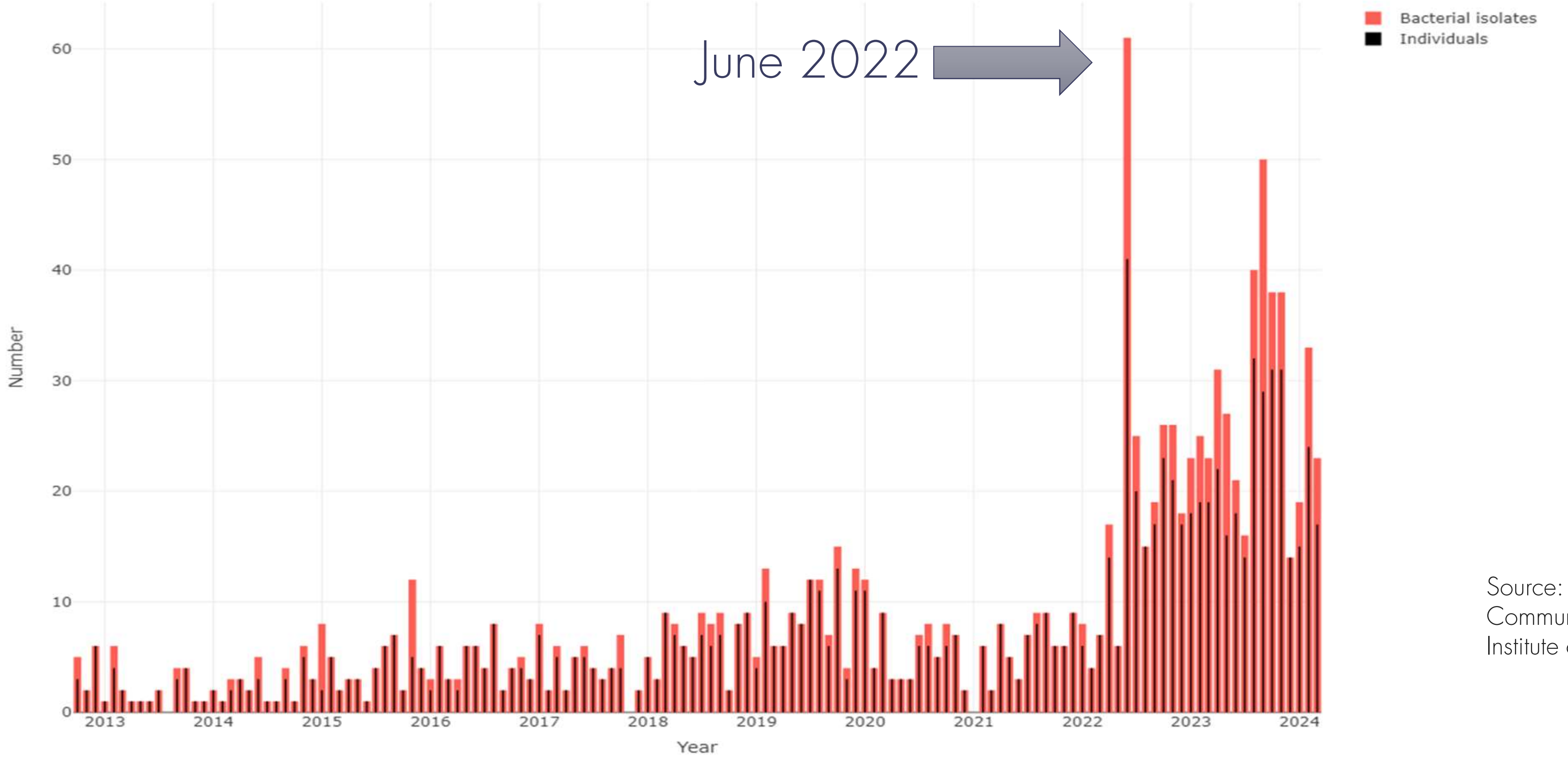
# EXPERIENCES FROM NORWAY ON RECEIVING PATIENTS FROM UKRAINE

Dr. Miriam Sare,
Senior Medical Officer,
Norwegian Institute of Public Health (NIPH), Norway

# National surveillance of Carbapenemase- producing bacteria (CPO)

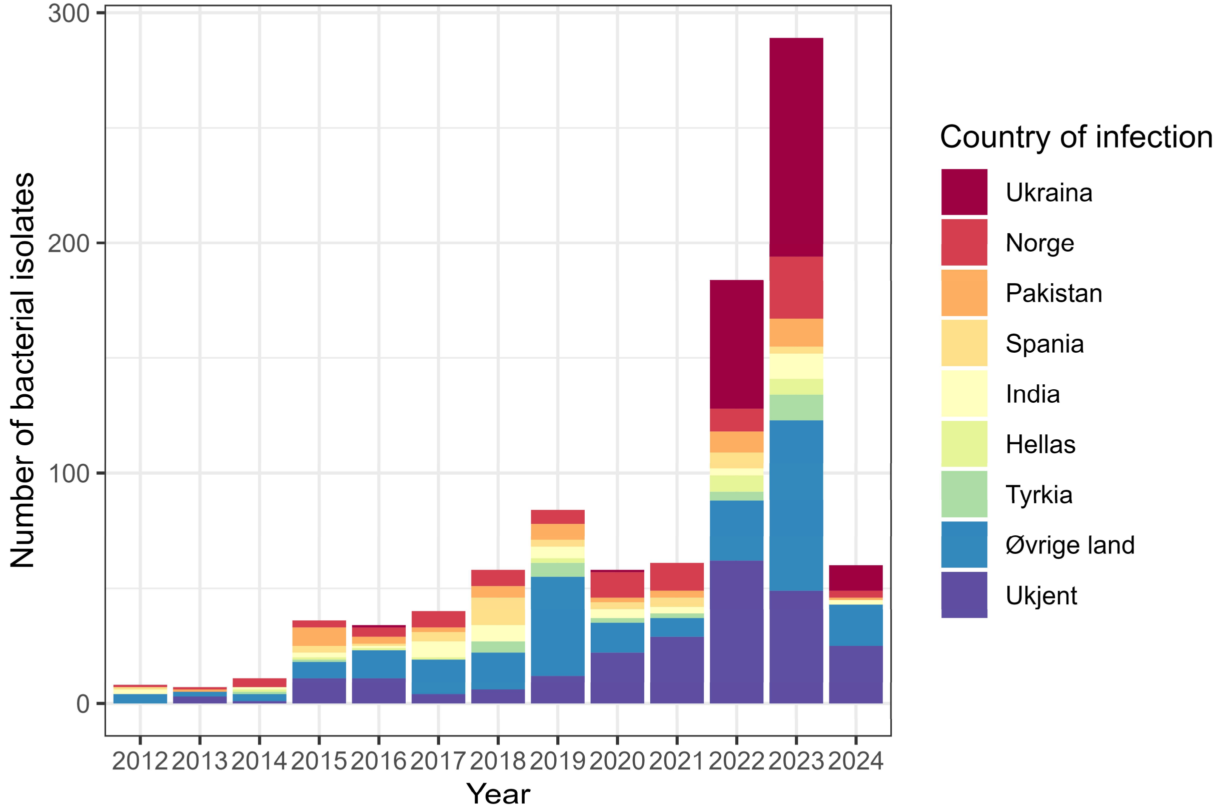



Source: Norwegian Surveillance System for Communicable Diseases (MSIS) at the Norwegian Institute of Public Health (NIPH)

FHI

# Carbapenemase-producing *Enterobacterales* in Norway

## 2012 until 17.04.2024




Source: Norwegian Surveillance System for Communicable Diseases (MSIS) at the Norwegian Institute of Public Health (NIPH)

# Insights from our collegaues at the hospital

Dr. Else Quist Paulsen, Clinical Microbiologist

Dr. Kristian Tonby, Infectious disease specialist Oslo University Hospital

# Status summer 2022

- Norwegian hospitals- little experience with complicated war injuries
- Antimicrobial resistance patterns previously not detected in Norway
- Use of antibiotics and treatment strategies with little documentation
- Limited/no access to broadspectrum antibiotics against XDR bacteria
- Patients with co-infections (MDR-TB, hepatitis) and mental trauma

# Summer 2022

Patient evacuated via Medevac evacuation system. Mine blast injury. Several surgical procedures in Ukrainian hospitals. Broadspectrum antibiotics in Ukraine.

Empirical antibiotic treatment for post operative sepsis?



Tonby 2023

Brutal and complex injuries

Good quality, life- saving treatment in Ukraina,

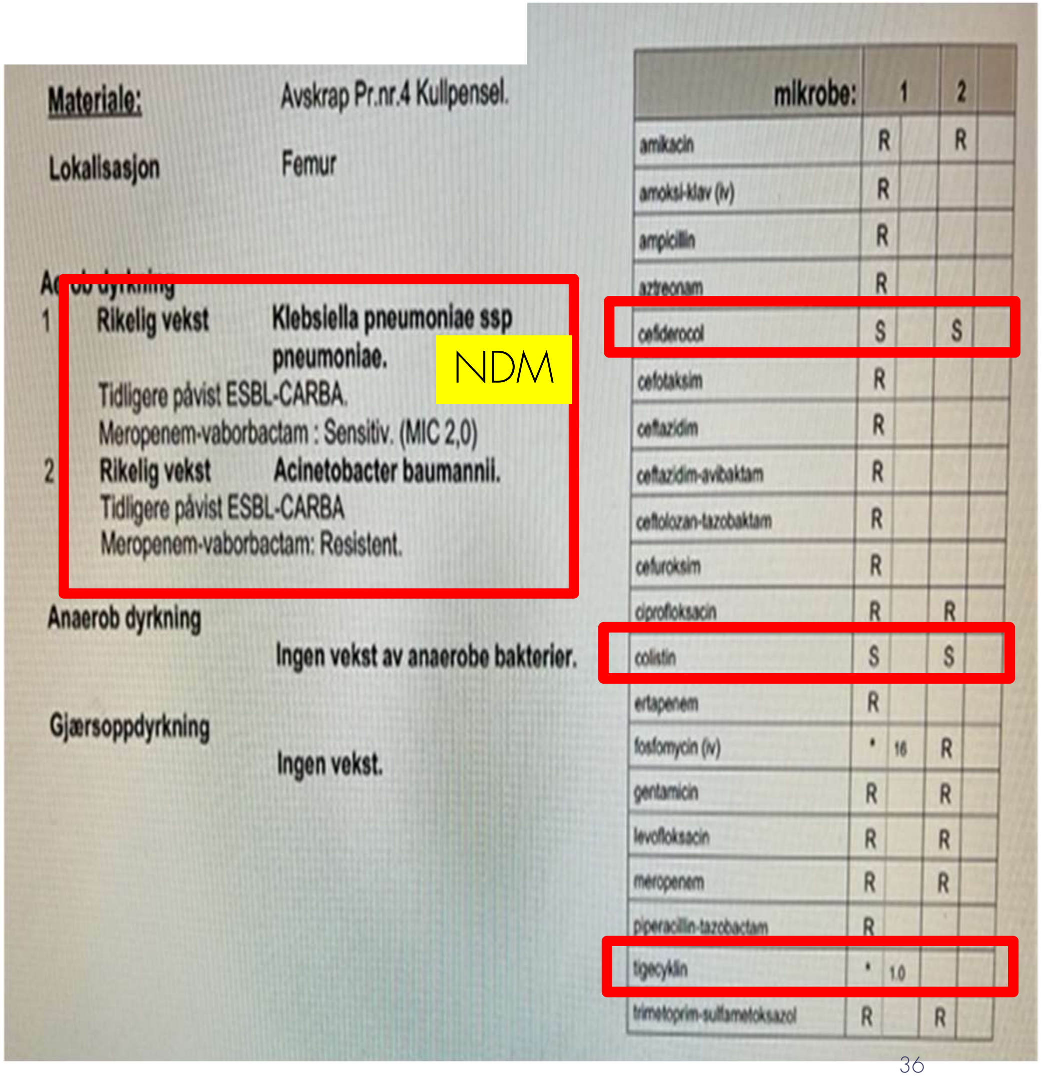
but extremely difficult conditions

#bacteria love war wounds

# Microbes with difficult to treat resistance patterns (XDR)

Short version of relevant sampling from 21 wound samples, 31 biopsies and 5 blood cultures:

- *Enterobacter cloacae* complex – ESBL CARBA (NDM)
- *Acinetobacter baumannii* – ESBL CARBA (OXA23)
- *Klebsiella pneumonia* – ESBL CARBA (NDM)



**Materiale:** Avskrap Pr.nr.4 Kullpensel.

**Lokalisasjon** Femur

**Aerob dyrkning**

1 **Rikelig vekst** **Klebsiella pneumoniae ssp pneumoniae.** NDM
Tidligere påvist ESBL-CARBA.
Meropenem-vaborbactam : Sensitiv. (MIC 2,0)

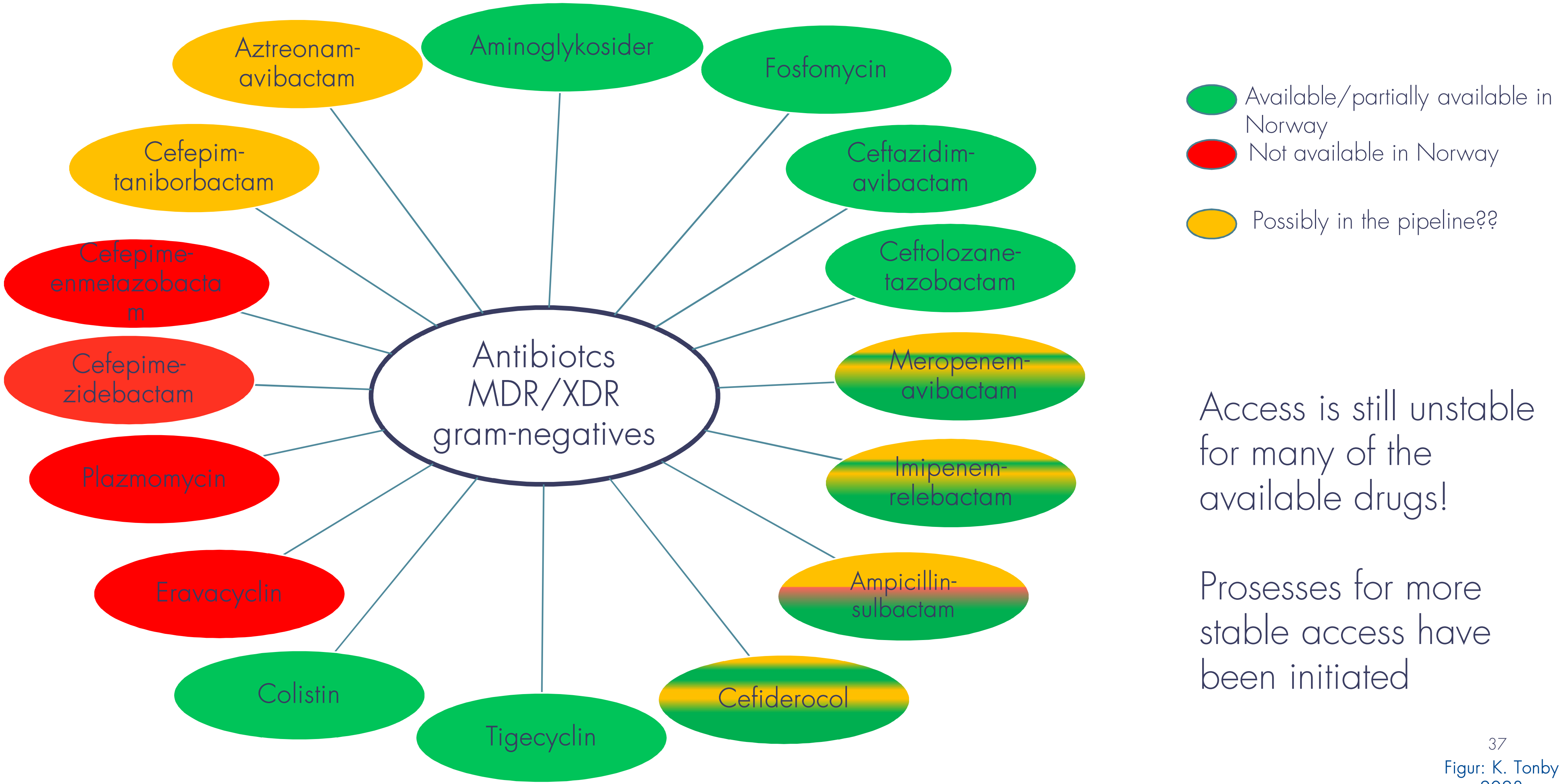
2 **Rikelig vekst** **Acinetobacter baumannii.**
Tidligere påvist ESBL-CARBA
Meropenem-vaborbactam: Resistent.

**Anaerob dyrkning** **Ingen vekst av anaerobe bakterier.**

**Gjærsoppdyrkning** **Ingen vekst.**

| mikrobe: | 1 | 2 |
|---|---|---|
| amikacin | R | R |
| amoksi-klav (iv) | R | |
| ampicillin | R | |
| aztreonam | R | |
| cefiderocol | S | S |
| cefotaksim | R | |
| ceftazidim | R | |
| ceftazidim-avibaktam | R | |
| ceftolozan-tazobaktam | R | |
| cefuroksim | R | |
| ciprofloksacin | R | R |
| colistin | S | S |
| ertapenem | R | |
| fosfomycin (iv) | * 16 | R |
| gentamicin | R | R |
| levofloksacin | R | R |
| meropenem | R | R |
| piperacillin-tazobactam | R | |
| tigecyklin | * 1.0 | |
| trimetoprim-sulfametoksazol | R | R |

# Available MDR antibiotics in Norway (gram-negative)




Access is still unstable for many of the available drugs!

Prosesses for more stable access have been initiated



Figur: K. Tonby 2023

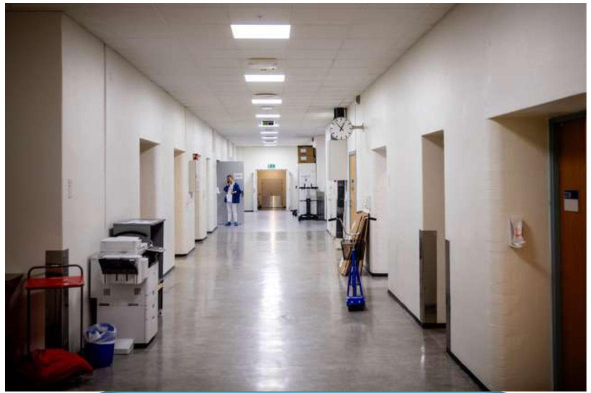
# "Medevac" hospital ward

Established 01.01.23, received patients since June 2022

Hospital ward at Ullevål Hospital, Oslo University hospital

Multidisciplinary team

- Orthopaedic surgeons
- Infectious disease specialists
- Microbiologist
- Infection control consultant



Support from:

Dep. of
- Plastic surgery
- Neurosurgery
- Anesthesia
- Radiology
- Psychiatry

Sosial worker
Nutritionist
Physiotherapy
Interpreters
+++++

# Patient logistics

- Screening samples (arrival)
- Single bedrooms, own toilet and bathroom
- Contact isolation

- Trained personel in MDR/screening (IPC) (nurses and MD's)
- Dedicated operation team

MRSA

MDT (inf.disease specialists, microbiologist, ortopedics):

- Telephone contact app. Daily (all new findings)
- Meeting 1x/week

## Screening for MDR’s in Ukrainian cohort

| Microbes | Nose | Throat | Perineum | Fecal | Axilla/groin |
|---|---|---|---|---|---|
| MRSA* | X | X | X | | |
| ESBL* | | | | X | |
| VRE/LRE | | | | X | |
| *A. baumanii*/ MDR* | | X | | X | X |
| *Candida auris** | X | | | | X |

*Extended screening sites on indication

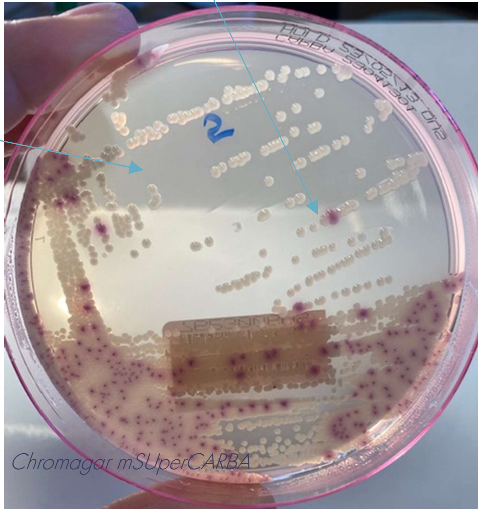
- ✓ X-ray
- ✓ 2x sampling 7 days apart
- ✓ Patient isolation, contact isolation and mask until negative

# Screening procedures in the lab


K. pneumoniae

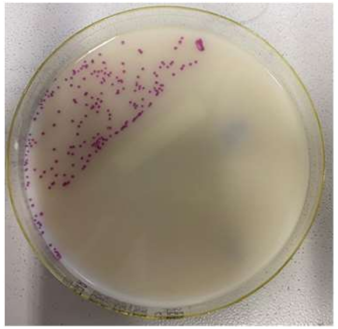
E. coli

A. baumanii

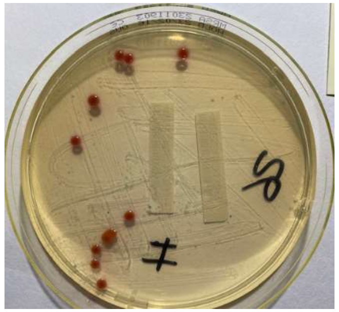



Combination disk test

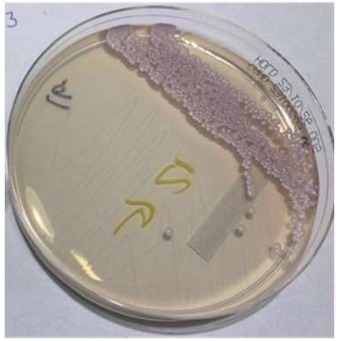
Molecular testing;
Xpert Carba
Easyplex SuperBug Acineto
Referance lab (K-res)



VRE



MRSA



C. auris