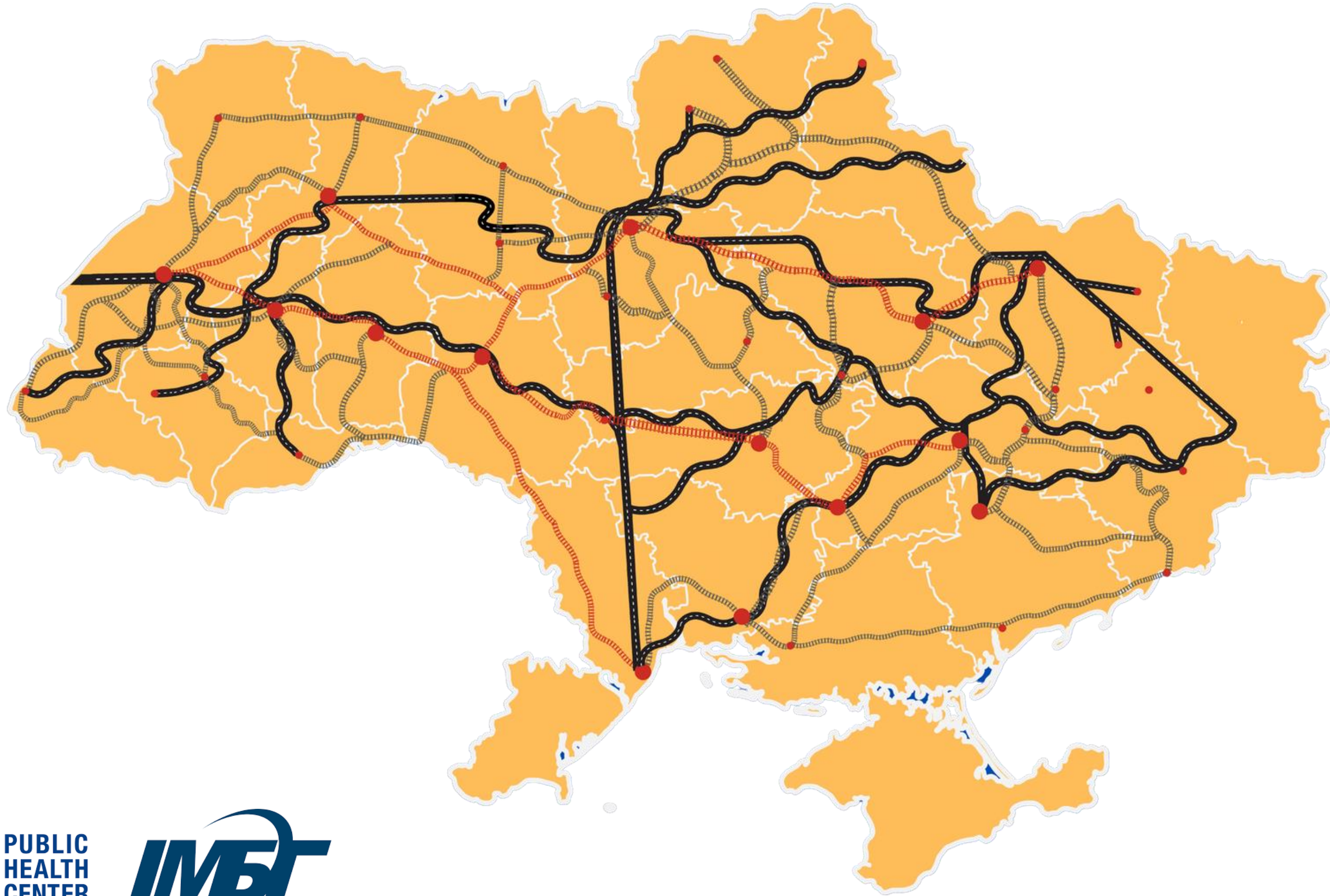


What part of war automatically equals infections?



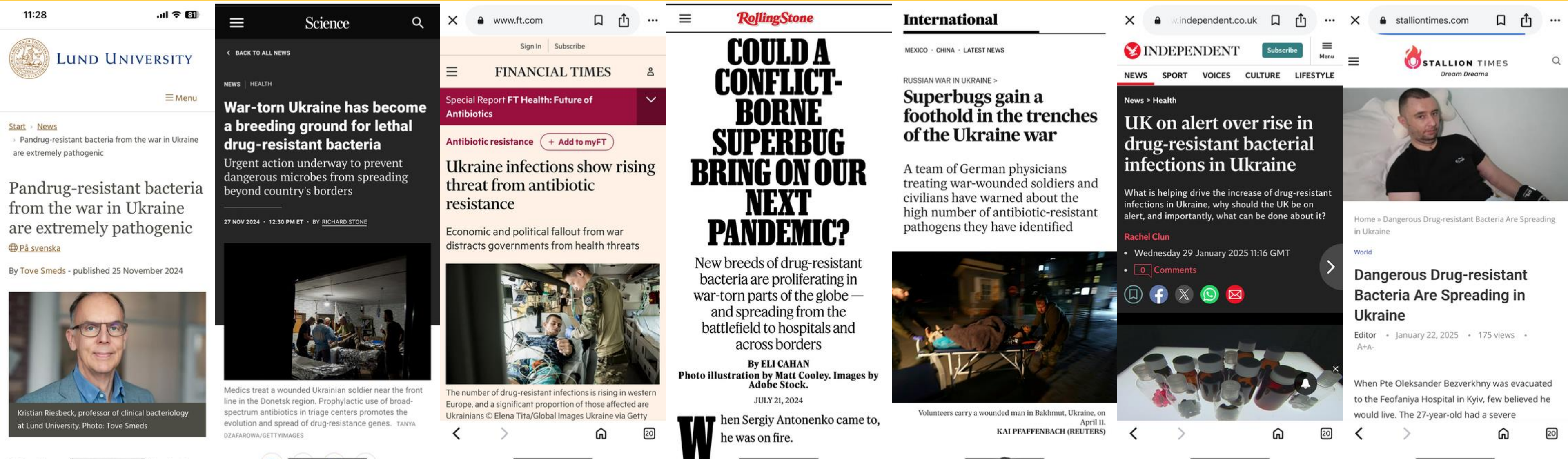
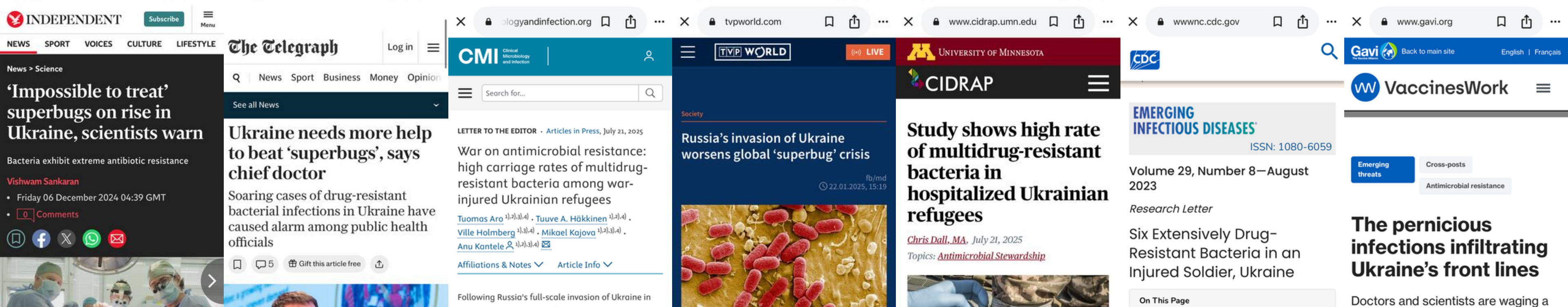
Disclaimers

GRANTS AND DONATIONS RECEIVED

- RAZOM FOR UKRAINE FOR SURVEILLANCE, INTERVENTION AND ASSESSMENT
- GRANT RECEIVED BY CANADA-UKRAINIAN FUND VIA MEDGLOBAL TO SUPPORT THE MICROBIOLOGY TEAM BIOCIDES PROJECT
- DONATION OF EQUIPMENT AND CONSUMABLES DONATED BY BIOMIQ™ NANOTESSE™ COPAN™, ROCHE™ AND UVX INC™
- US, BELGIAN AND POLISH ARMY SPECIAL FORCES MEDICAL, CBRN, AND CIVILIAN AFFAIRS FOR THE FULL-SCALE SIMULATION TRAINING

PROFESSIONAL AFFILIATIONS:

- ADJUNCT LECTURER FOR GRIFFITH UNIVERSITY
- CHIEF SPECIALIST OF ANTIMICROBIAL RESISTANCE AND INFECTION CONTROL PUBLIC HEALTH CENTER OF THE MOH OF UKRAINE
- PAID CONSULTANT FOR RAZOM FOR UKRAINE FOR DURATION OF THE PROJECT



INFECTION RATES ACROSS THE COUNTRY

ROLE 4
Present 10-25 days post-injury
>90% infected with 3-4 MDROs

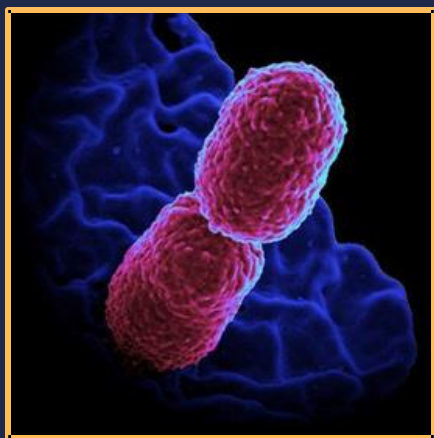
ROLE 3
Present 5 days post-injury
90% infected with 1-2 MDROs

ROLE 3
Present 5 days post-injury
50% infected with >1 MDROs

ROLE 3
Present 5-10 days post-injury
90% infected with 3-4 MDROs



The infections in Ukraine, 45 miles away from the border of Poland



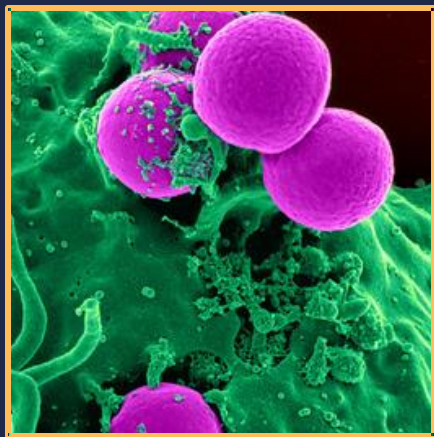
Klebsiella pneumoniae

28%
Pan-resistant



A. baumannii

37%
Pan-resistant



S. aureus

20%
MRSA



Pseudomonas aeruginosa

19%
Pan-resistant

Чутливість мікроорганізмів			
Найменування препаратів	Klebsiella pneumoniae 10^7	Acinetobacter spp. 10^3	Pseudomonas aeruginosa 10^5
Ампіцилін	***		
Амікацин	*C	*C	*C
Амоксицилін- клавунат	*C		
Азтреонам	*C		*C
Цефотаксим	*C		
Цефокситин	*C		
Ципрофлоксацин	*C	*C	*C
Левовфлоксацин	*C	*C	*C
Гентаміцин	*C	*C	
Тікарцилін-клавуланат	***		*C
Тобраміцин	*C	*C	*C
Тріметопрім-Сульфаметоксазол	*C	*C	
Цефепім	*C		*C
Меропенем	*C	*C	*C
Імепенем	***	***	***
Піперацилін-тазобактам	*C	*C	*C
Цефтріаксон	*C		
Цефтазідім	*C		*C
Цефтазидин-авібактам	*C		*C
Цефтолазан-тазобактам	***	***	***
Пефлоксацин	***		
Цефтазидим		*C	***
Піперацилін			*C

*C - стійкий
*П – чутливий, збільшена експозиція
*Ч – чутливий

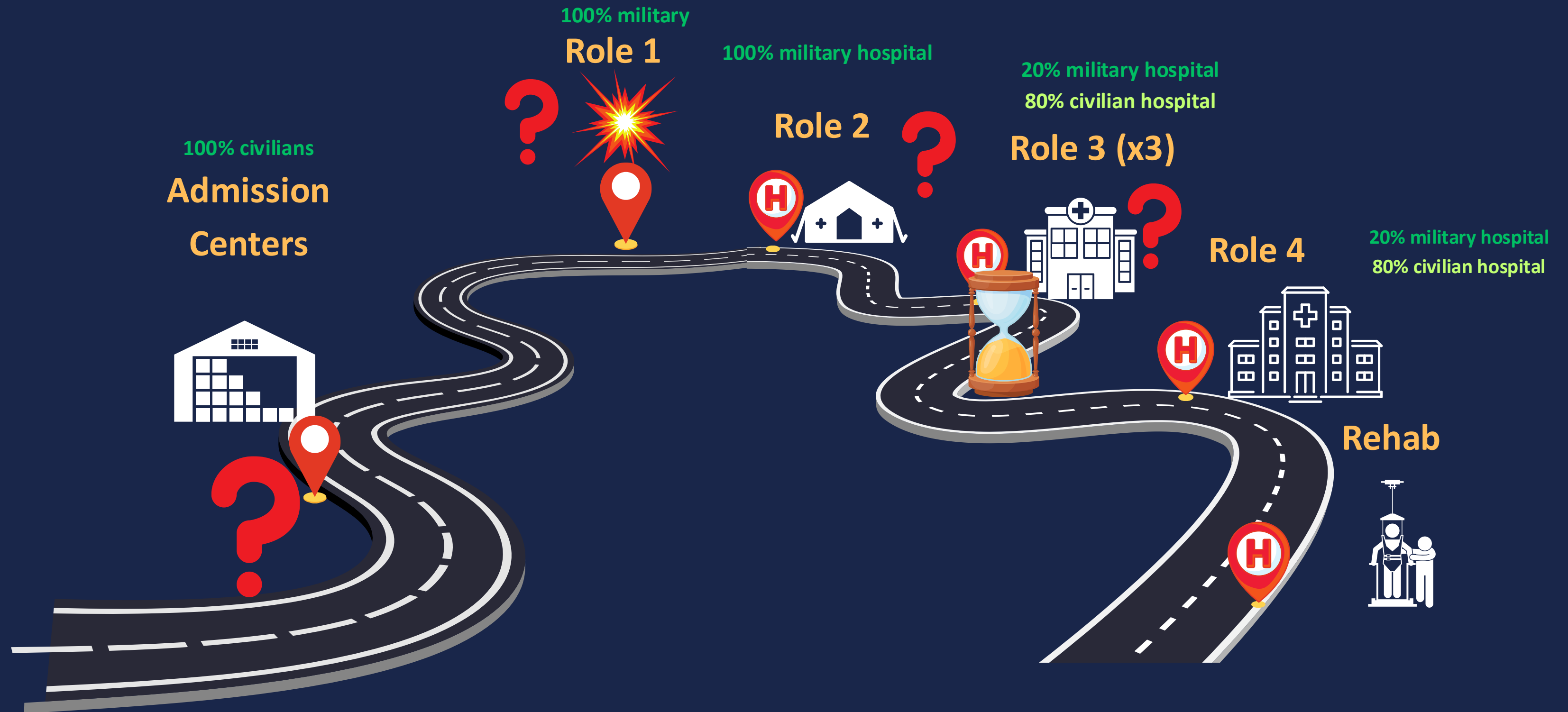
4 hypotheses as to why the infection crisis

1. The Ukrainians carry the MDROS as part of normal skin flora and microbiome
2. The contamination from the prolonged battlefield evacuation → colonization → systemic infection
3. Cross transmission before role 3 between casualties, healthcare workers, medical equipment, vehicles etc
4. Cross transmission in Role 3 + due to dirty, contaminated hospitals, poor IPC, irrational antibiotics

****Other factors to consider, malnourishment, smoking, dehydration, hypovolemia leading to poor perfusion**

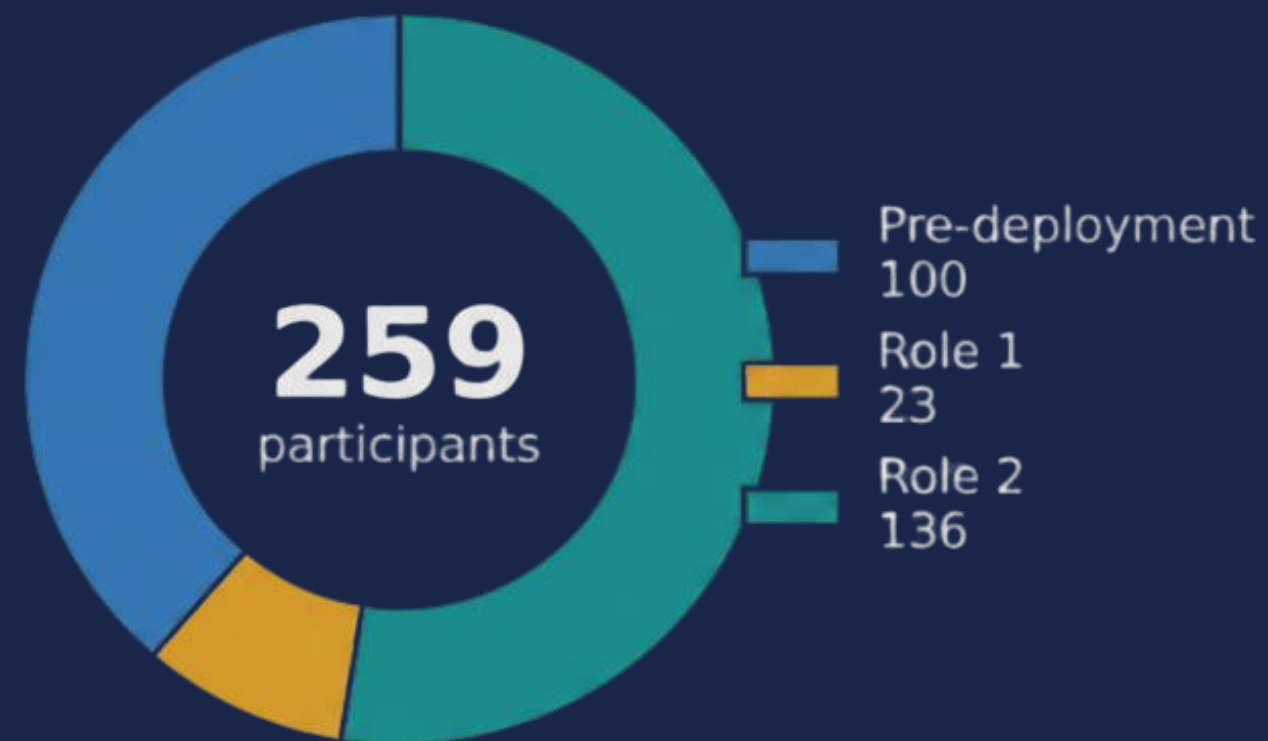
Aim of research: confirm or deny each hypothesis so targeted interventions can be made

STUDY 1: SURVEILLANCE OF PARTICIPANTS AT EVERY LEVEL OF THE TRAUMA EVACUATION PATHWAY



INTERIM FINDINGS

TOTAL SAMPLE SIZE AT EACH LEVEL OF CARE = 400 PARTICIPANTS FOR 95% CI AND 5% MARGIN OF ERROR



Average length of time from POI until sampling:

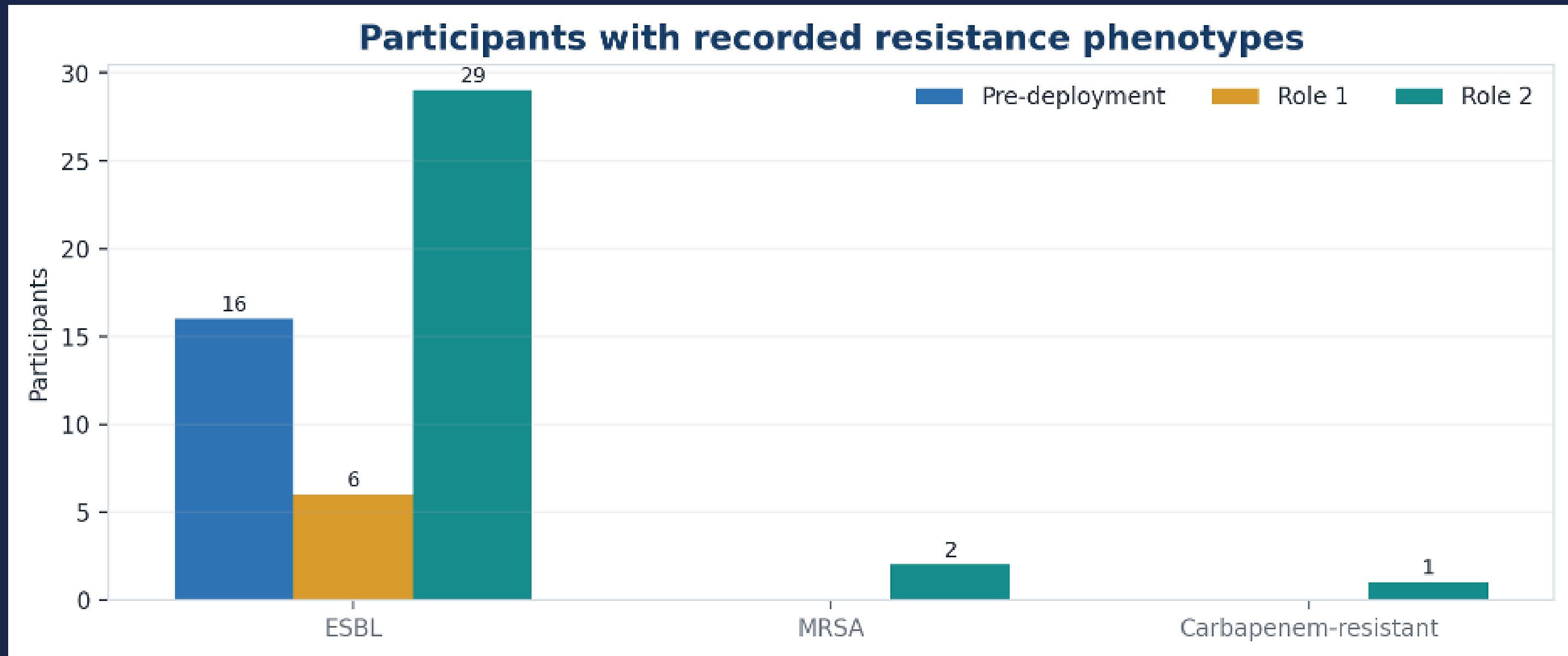
Pre-deployment: no exposure to nosocomial conditions or antibiotics within prior 90 days.

Role 1: Range 1.3 to 288 hrs (12 days)

Role 2: Range 1 to 720 hours (30 days)

INTERIM FINDINGS

TOTAL SAMPLE SIZE AT EACH LEVEL OF CARE = 400 PARTICIPANTS FOR 95% CI AND 5% MARGIN OF ERROR



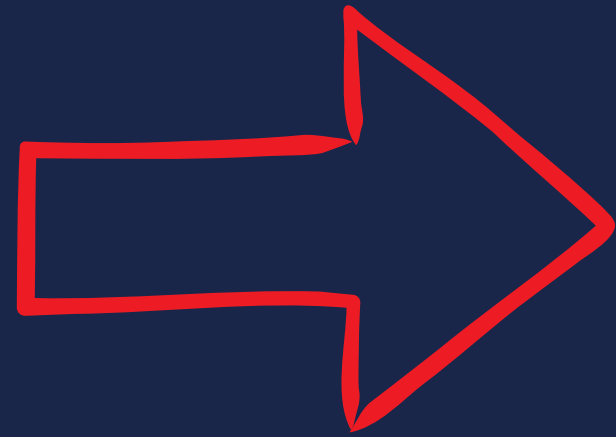
PRE-DEPLOYMENT
16% ESBL detected

ROLE 1
26.1% ESBL detected

ROLE 2
21.3% ESBL detected

What contaminants exist in the environment, and does direct contamination lead to infection once we've lost the Golden Hour?

WE DO NOT KNOW. WE SHOULD KNOW



1. Hemostasis
2. Tourniquet
3. Wound assessment
4. Sterile Dressing

1. Hemostasis
2. Tourniquet application
3. Wound assessment
4. Irrigate??
5. Apply antiseptic??
6. Residual antimicrobial barrier?
7. Sterile dressing

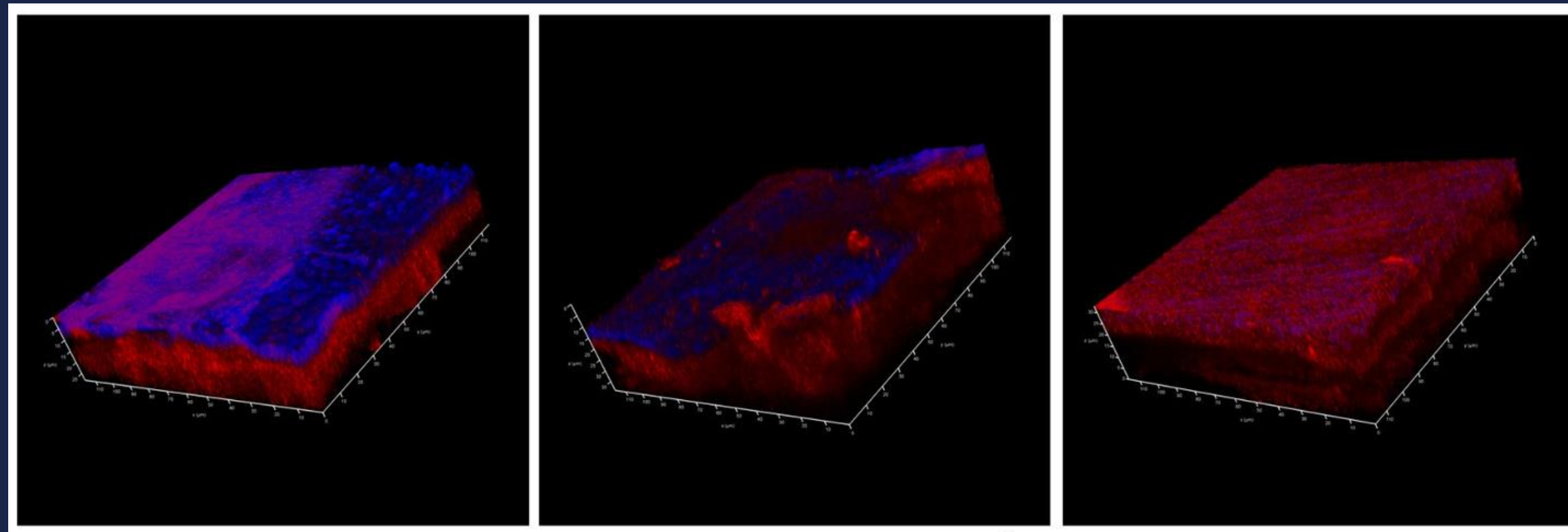
STUDY 2: DETERMINING IF NON-PHARMACOLOGICAL INFECTION PREVENTION IS EFFECTIVE AGAINST UKRAINE'S MDROs



STUDY 2: INCIDENTAL INTERIM FINDINGS

WHILST WE WAIT FOR THE ANTISEPTIC EFFICACY RESULTS, THE MICROBIOLOGY TEAM
INCIDENTALLY DETERMINED THAT THE STABILITY OF THE BIOFILM INCREASES WITH
COLLAGEN DENSITY

2-day old biofilms produced by Carbapenem-resistant *P. aeruginosa*



Control polystyrene surface

Polystyrene surface with
62.5µg/mL collagen

Polystyrene surface with
125µg/mL collagen

A sputum sample was collected from a patient at the 45 miles from the border of the EU

Антибіотик	Мікроорганізм 1 <i>Proteus mirabilis</i>	Мікроорганізм 2 <i>Klebsiella pneumoniae</i>	Мікроорганізм 3 <i>Pseudomonas aeruginosa</i>	Мікроорганізм 4 <i>Providencia stuartii</i>	Мікроорганізм 5 <i>Stenotrophomonas maltophilia</i>
Ампіцилін	стійкий	-	-	-	-
Амоксицилін	стійкий	-	-	-	-
Амоксицилін/клавунат	стійкий	стійкий	-	-	-
Піперацилін/тазобактам	чутливий	стійкий	стійкий	-	-
Тікацилін/клавунат	чутливий	-	стійкий	-	-
Цефуроксим	стійкий	стійкий	-	стійкий	-
Цефотаксим	стійкий	стійкий	-	стійкий	-
Цефтріаксон	стійкий	стійкий	-	стійкий	-
Цефтазидим/авібактам	чутливий	стійкий	-	стійкий	-
Цефепім	стійкий	стійкий	стійкий	Помірно чутливий	-
Цефідерокол	чутливий	чутливий	чутливий	чутливий	чутливий
Амікацин	стійкий	стійкий	стійкий	стійкий	-
Гентаміцин	стійкий	стійкий	-	стійкий	-
Тобраміцин	стійкий	стійкий	стійкий	стійкий	-
Пефлоксацин (скринінг)	стійкий	стійкий	-	стійкий	-
Ципрофлоксацин	стійкий	стійкий	стійкий	стійкий	-
Моксифлоксацин	стійкий	стійкий	-	стійкий	-
Левовфлоксацин	стійкий	стійкий	стійкий	стійкий	-
Меропенем	чутливий	стійкий	стійкий	чутливий	-
Іміпенем	чутливий	стійкий	стійкий	чутливий	-



PULMONARY MANIFESTATIONS

Symptom	CS Gas	Chloropicrin	<i>Klebsiella pneumoniae</i>	<i>Pseudomonas aeruginosa</i>	Dirty Bomb (RDD)	Orphan Radioactive Sources	Nuclear Power Plant Explosion
Cough	✓	✓	✓	✓	✓	✓	✓
Throat irritation	✓	✓	—	—	✓	✓	✓
Dyspnoea	✓	✓	✓	✓	✓	✓	✓
Chest tightness	✓	✓	✓	✓	✓	✓	✓
Wheezing / broncho-spasm	✓	✓	✓	✓	—	—	—
Pulmonary edema	—	✓	✓ (in severe cases)	✓	✓ (high-dose)	✓ (high-dose inhalation)	✓ (in radiation pneumonitis)
Radiation pneumonitis	—	—	—	—	✓	✓	✓
Hemoptysis	—	✓ (severe)	✓	✓	✓ (late effect)	✓	✓

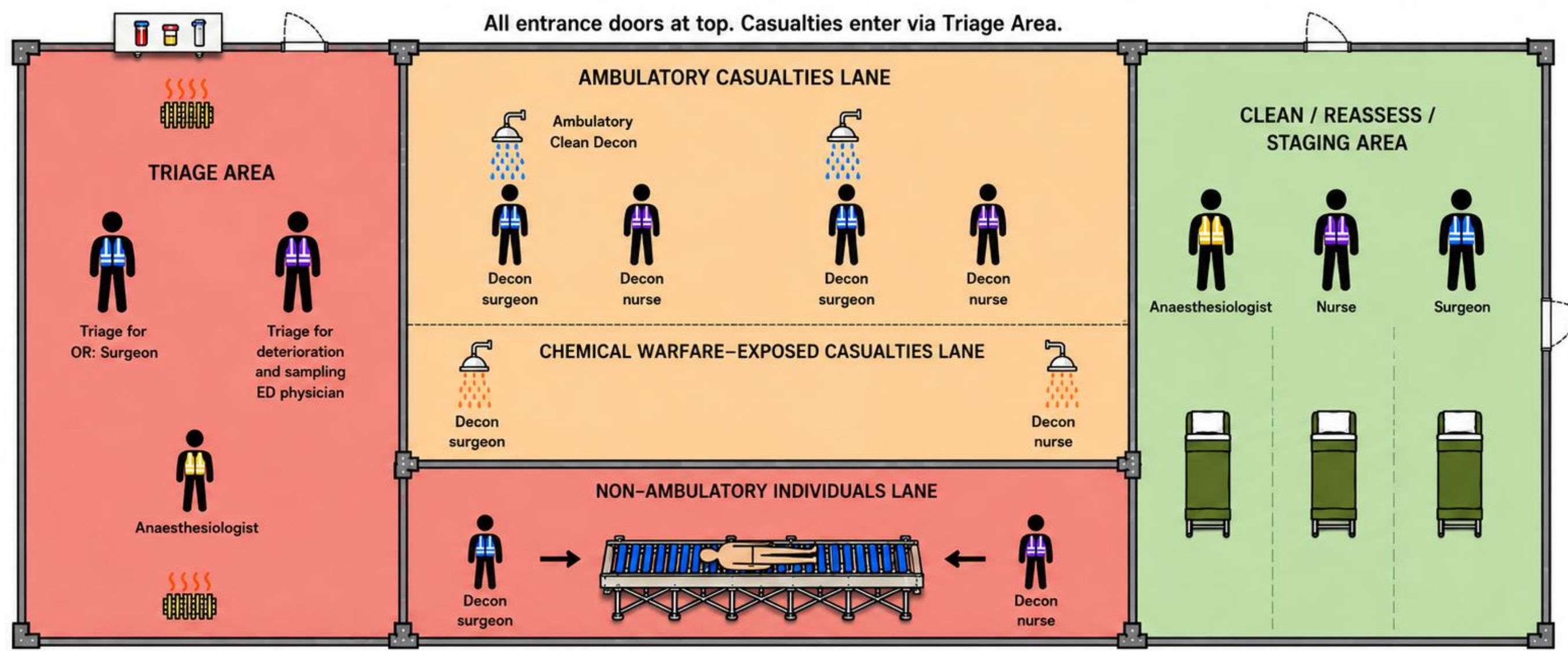
I pose this question: If the bacteria present in Ukraine are no longer treatable with antibiotics in up to 30-40% of the wounded, how does the impact of these bacteria differ to the outcomes of exposure of chemical, biological, radiological, and nuclear weapons?

If this was exposure to anthrax, would we be waiting for the casualty to become symptomatic before initiating treatment?

STUDY 3: FULL SCALE SIMULATION TO DETERMINE WHETHER WE COULD ADAPT BIOLOGICAL-WARFARE INSPIRED DECONTAMINATION TO REDUCE MDRO CARRIAGE ON CASUALTIES PRE-HOSPITAL



STUDY 4: DETERMINING THE SAFETY, EFFICACY AND EFFICIENCY OF IMPLEMENTING THE PRE-HOSPITAL DECONTAMINATION UNIT IN SITU



FLOW SEQUENCE

- TRIAGE AREA** – Initial assessment and prioritization
- NON-AMBULATORY DECON** – Conveyor-assisted decontamination
- DECONTAMINATION LANES** –
 - Upper: Ambulatory clean decon
 - Lower: Chemical warfare-exposed casualties decon
- CLEAN / REASSESS / STAGING** – Post-decon assessment and staging

1

2

3

4

→ Flow Direction (Casualty Movement)

LEGEND

Surgeon / Physician

Nurse / Medical Staff

Anaesthesiologist

Heater (Optional)

Decontamination Shower (Clean)

Decontamination Shower (Chemical Exposure)

Conveyor for Non-ambulatory Casualties

Staging / Cot

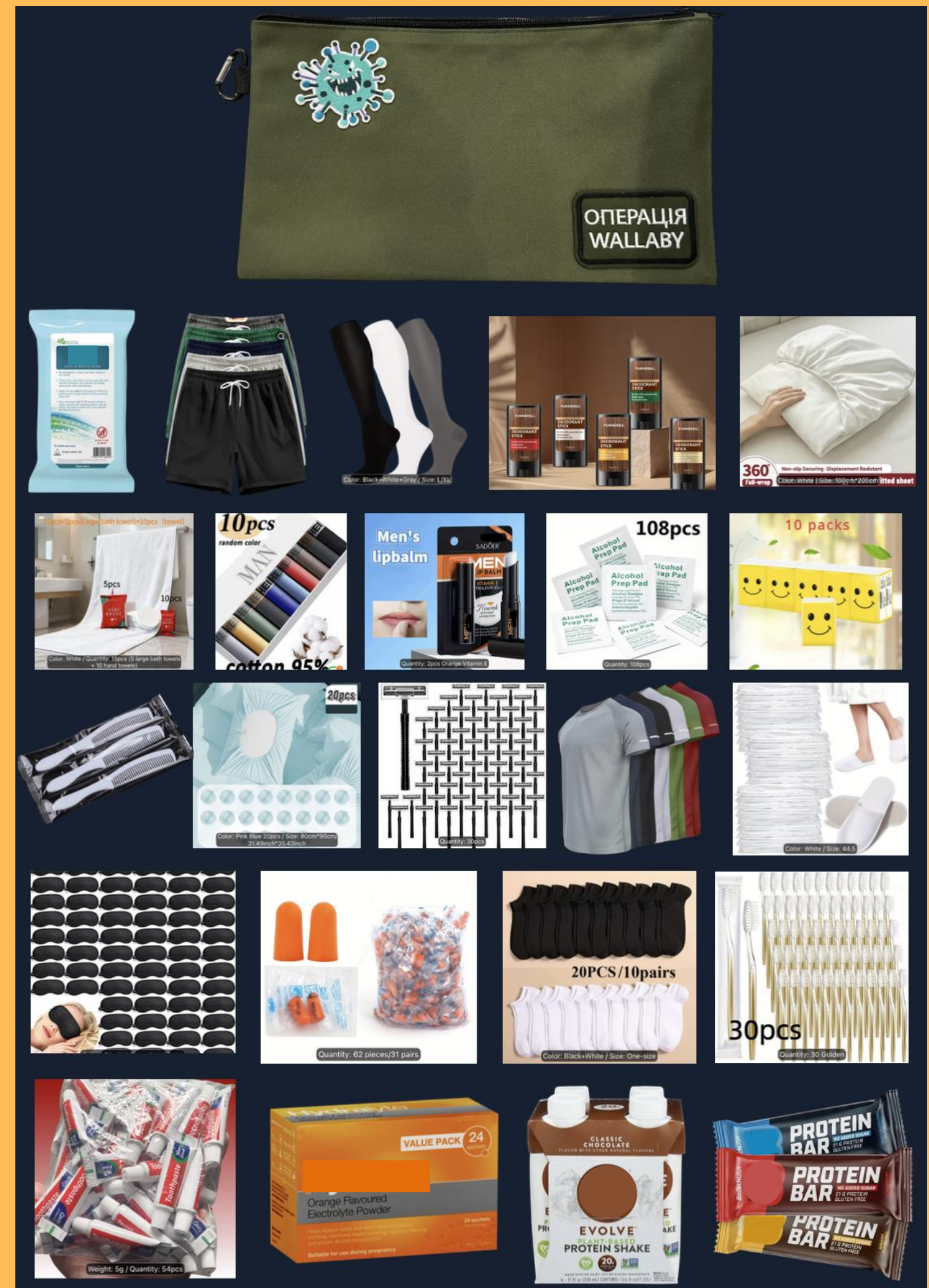
NOTES

- All lanes (Triage, Non-ambulatory, Ambulatory, Chemical lane, Clean/Staging) are equal size.
- Casualties enter through the top (Triage Area).
- Doors at top for entry flow and on right side of clean area for exit flow.
- Heaters shown are optional for cold-weather operations.
- Dimensions represent modular inflatable or frame-supported tents.

STUDY 6: PROVISION OF EVIDENCE-BASED KITS AND INFORMATION TO IMPROVE HEALTH LITERACY IMPROVES OUTCOMES FURTHER

We provide pouches filled with self-care items and instructions to build health literacy for casualties to engage in their own self-care. There is a nursing ratio of 1-2:60 casualties → casualties MUST partake in their own care

Daily body cleaning, adequate protein intake, and regular tooth brushing are evidence-based therapeutic practices.



STUDY 7: THE “ONE HEALTH” CHECK

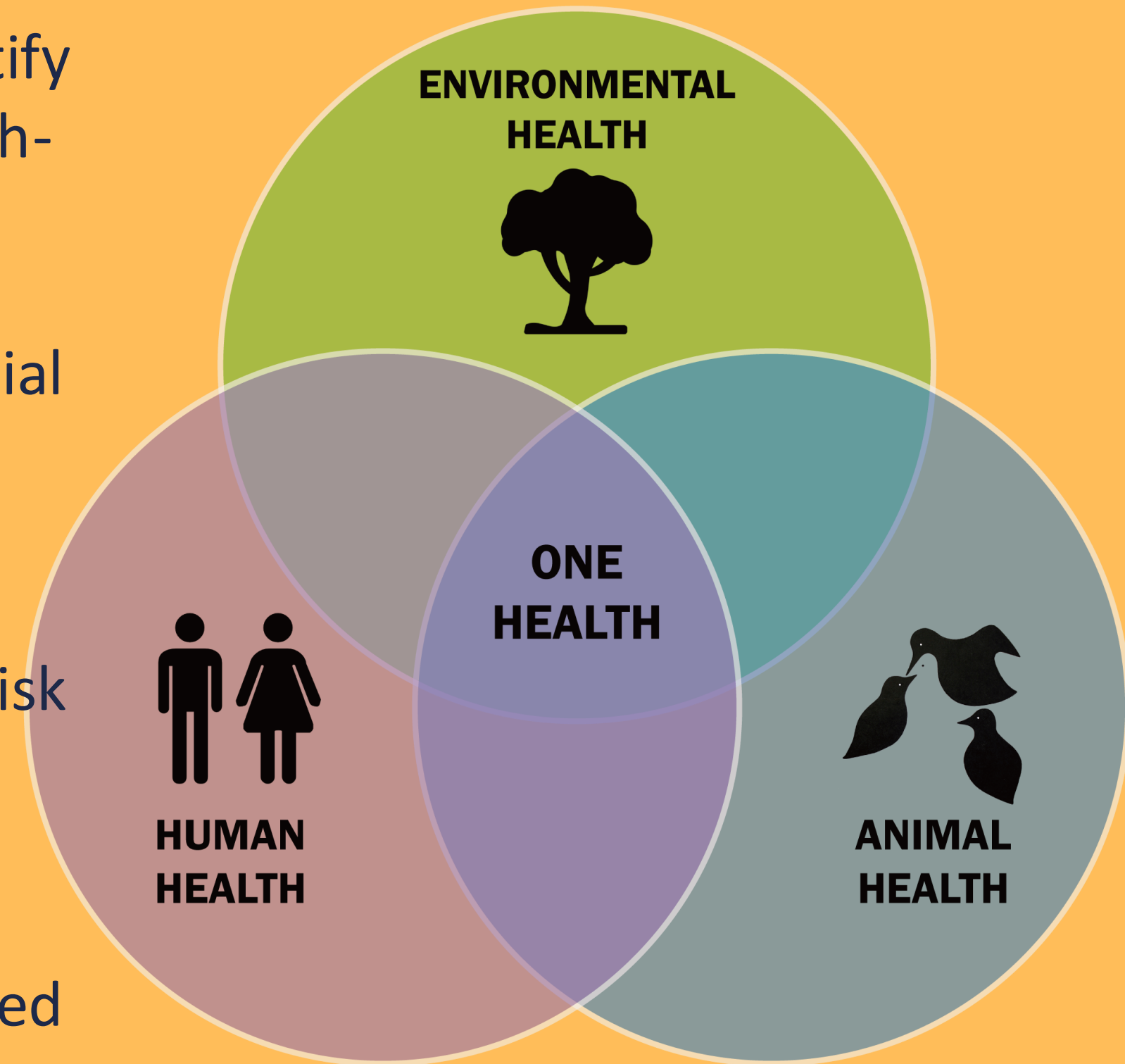
We’re using a lot of antiseptic.

Pre- and post-wastewater analysis is conducted to quantify the ecological and antimicrobial resistance impact of high-volume antiseptic use during decontamination.

It enables detection of residual biocides, shifts in microbial load, and selection of resistant organisms, including MDROs and fungi.

This ensures the intervention reduces patient infection risk without inadvertently amplifying environmental AMR transmission or downstream public health threats.

This also is a form of evidence of chemical warfare cleaned from casualties (collab with Ukr. MoD CBRNE unit)



STUDY 8: LINKING THE INTERVENTION WITH TARGETED EVACUATION”

- The less hospitals the wounded pass through, the reduced risk of constant accumulation of MDROs
- We aim to partner with specialized plastic/reconstructive surgical hospitals for definitive treatment, bypassing (often) 3-4 “Role 3” capacity hospitals currently in the trauma evacuation pathway.
- The shorter the evacuation to a Role 4/5 capacity hospital, the less repeated risk of cross-transmission between nosocomial environments, and less risk of transmission to civilians within those hospitals.

WHAT DOES SUCCESS IN THIS PROJECT MEAN?

1. Saving Lives and Salvage Limbs in Ukraine

Reduce infection, sepsis, infection-related amputation, and mortality among war-wounded casualties.

2. Protecting the biosecurity of Europe and beyond

Reduce the international spread of highly resistant pathogens before they become entrenched within healthcare systems across Europe and beyond.

3. Preparing partner and allied countries for future conflict:

Developing and validating the medical capabilities that allied and partner nations will require in future LSCOs

**UKRAINE IS TEACHING THE WORLD HOW TO FIGHT HELP US ENSURE IT ALSO
TEACHES THE WORLD HOW TO SAVE LIVES.
LESSONS LEARNED NOW IN UKRAINE WILL SAVE LIVES IN THE FUTURE.**

THANK YOU,
ДЯКУЮ

HAILIE UREN
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- Chief Specialist of Antimicrobial Resistance and Infection Control Public Health Center of the Ministry of Health of Ukraine
- Principal investigator of an 8-phase combat casualty care innovation project in collaboration with the Ministry of Defence of Ukraine, Razom for Ukraine and the Institute of Molecular Biology and Genetics with support from MedGlobal and the Canada-Ukrainian Fund