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Follow Mihir Melwani on Twitter

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How war is spreading drug resistant superbugs across Ukraine and beyond

The rush to transport patients to specialist aid is driving antimicrobial resistance in Ukraine—and beyond. **Mihir Melwani** reports

Mihir Melwani *freelance journalist*

Fifteen year old Ana lost her family to a Russian rocket strike. She survived the attack, but ultimately lost her life to an invisible enemy: drug resistant bacteria.

When rockets fell from the sky on her home in eastern Ukraine—not far from the frontline—Ana was critically wounded and taken to a local hospital. Samples from her wounds were sent to the laboratory for culturing and an infection of a multidrug resistant strain of *Klebsiella pneumoniae* bacteria was found.

Ana, whose name has been changed for privacy, was suffering from severe bleeding and shrapnel injuries—penetrating pelvic injuries and extreme soft tissue damage to the right thigh. “You can’t imagine the trauma. It was like half of her thigh was just broken,” Denis Surkov, one of the doctors who treated her, describes. The infection spread and sepsis set in. Soon, Ana would experience multiple organ failure, and spend six weeks in an intensive care unit (ICU).

After finally stabilising, she was transferred across the country to Surkov’s western Ukraine paediatric hospital, but the infection was uncontrollable. Septic shock set in again, and four days later Ana became another statistic of the war.

“We collect the most severe paediatric patients from eastern hospitals,” says Surkov, who is deputy medical director for anaesthesiology and intensive care at St Nicholas Children’s Hospital in Lviv. “At least two thirds of patients already have hospital acquired, multidrug resistant strains of bacteria. It’s a huge problem because of high mortality.”

The infection that killed Ana was resistant to all the antibiotics that the hospital had on hand, including imiprenum and menoprenum, often seen as a last resort for the most resistant bacteria.

Hotbed for antimicrobial resistance

Antimicrobial resistance is not a new problem, says Ostap Zubach, an orthopaedic and trauma surgeon at Lviv’s Medical Union Hospital. “People have been fighting it for a while. But in the case of war, it becomes more dramatic.”

Chaotic scenes are now the norm in Ukraine, and proper hygiene has become a victim of the rush to transport the wounded away from battlefields and to specialist help.

Since the war began, Zubach’s patients have been facing major blast wounds—including soft tissue damage, compound fractures, and third degree burns.

“Like many Ukrainian doctors, I dream about clear surgery. But war breeds special wounds. Contamination is a big problem,” he says.

Blast injuries from artillery shells and mines mean all sorts of dirt, dust, and metal shrapnel—known as explosive metabolites—are contaminating these wounds, causing infections that aren’t responding to first line antibiotics.

On top of this contamination, the migration of civilians and patients from Ukraine’s east to west has resulted in the spread of bacterial flora from one region to another, increasing the potential for the spread of drug resistant bacteria between patients in hospitals.

Military casualties go through a messy evacuation and hospital admission process, being passed from one ambulance to the next and stabilised by their comrades along the way. Once out of the red zone, they’re brought either to a field hospital or to a nearby regional hospital.

Life comes first on the frontline, and hygiene is not a priority when vehicles are often outrunning targeted Russian shelling and gunfire. A combat medic source reports sanitising his ambulance with a chlorhexidine detergent solution “according to the schedule, not specifically after each casualty.”

Those who require more complex procedures and care are often transported to central or western Ukraine—many to Zubach’s ward—but passing a patient between hospitals has consequences. Zubach receives many patients on medical evacuation trains coming from Ukraine’s east—and the sheer volume of patients carrying the bacterial flora of the emergency departments they’ve been admitted to is causing surges of drug resistant infections. “It’s a wartime traumatic epidemic,” he says.

Too easy to access

Historically, Ukraine has been relaxed in its control of antibiotics. Any patient could go to a pharmacy and buy them without a prescription.

As broad spectrum antibiotics are used for simple infections, sensitive microbes are killed, leaving behind bacteria that are resistant to the given drug.

In August 2022, the Ukrainian ministry of health implemented a new process where all patients are required to obtain a prescription from their doctor before buying antibiotics. This move was introduced to reduce abuse of antibiotics by patients, and is the

first step to controlling the outbreak of drug resistant infections.

In hospitals, wounds are cultured and tested to determine which antibiotics can fight against the infection—but this can take time as samples need to be transported to laboratories in bigger specialist hospitals in cities. Doctors will often use their professional judgment, choosing an antibiotic at hand in the hope that it will work, as they wait for the laboratory results.

“The most important difference between civilian medicine and medicine in combat settings is the time from injury to medical facility,” Surkov says. By the time patients make it to the hospital, the infection has developed. He suggests employing antibiotic prophylaxis for all patients with severe open wounds, and says these must be administered in the hour following serious wounding injuries. The Tactical Combat Casualty Care Guidelines—the army medic’s bible—outline antibiotic administration following a severe injury as standard protocol. But many medics on the frontline don’t administer them.

“We can’t stop the rise of drug resistant infections, but we can diminish the ratio of wounded and septic patients in time,” Surkov says.

Vicious cycle

It’s a vicious cycle. From a longer term perspective, doctors compensating for the slow turnaround time of the laboratory tests with broad spectrum antibiotics cause a feedback loop in which the resistant bacteria survives and further colonises, causing these first line drugs to become less effective. This also applies to the use of antibiotic prophylactics suggested for combat injuries—the prophylaxis may save lives today and take them tomorrow.

Serhiy Tarnopolskyi, a doctor-surgeon at the purulent-septic centre of Mechnikov Hospital, reports many multidrug resistant strains of bacteria in the 550 wounded soldiers and civilians passing through his sepsis ward.

The hospital is one of Ukraine’s biggest; located in the eastern city of Dnipro, it’s seen thousands of soldiers and civilians pass through since the beginning of the war in February. The hospital has plenty of experience with war injuries, having been involved in the treatment of casualties since the 2014 war in the Donbass.

“Combat trauma often leads to large, contaminated wounds with necrosis of soft tissues and bones—an optimal environment for the development of hospital acquired bacterial infections,” Tarnopolskyi says. If left untreated—or if the infection doesn’t respond to any drugs on hand—patients face multiple organ failure and death.

Many of the patients passing through Tarnopolskyi’s ward suffer from wounds with a “blue-green pus”—a tell tale sign of an infection bearing the bacterial strain *Pseudomonas aeruginosa*. Tarnopolskyi recalls a military casualty who had his bandages turn green on his 7th day in the ICU. Four different antibiotics were administered but he died of multiple organ failure on the 14th day.

One can understand each doctor’s dilemma, particularly at a time of war. The problem is, says David Jenkins, president of the British Society for Antimicrobial Chemotherapy, these bacteria don’t stay in hospitals. “They spread from place to place, through watercourses, and through animals and food. What happens in one place can affect the other side of the world within a relatively short period of time.” As some of these patients are brought to western Europe for further care, threats are posed outside Ukraine as well.

Jenkins knows all too well about the dangers of spreading drug resistant bacteria. When a patient repatriated from Spain was

improperly isolated in his Leicester hospital in 2018, the drug resistant bacteria he was carrying managed to colonise and spread to over a hundred other patients in the hospital. Now, it’s endemic, and Jenkins sees patients from the Leicester community coming into his ward with the same strain.

“Drug resistant bacteria are a big problem, not just in Ukrainian healthcare systems,” Surkov explains. “It will be a problem for Europe—Ukraine is already the source of multiple resistant strains. We must find the way together to save lives in Ukraine and Europe.”

Additional reporting by Vlad Fisun.

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