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A Lesson from a Pandemic for Health Professionals: The Impact of COVID-19 on the Spread of Treatment-Resistant Bacteria

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Dear Editor,

The COVID-19 pandemic significantly exacerbated the spread of treatment-resistant bacteria, particularly in healthcare settings, due to increased antibiotic use, strained healthcare systems, and disrupted surveillance efforts. This global health crisis intensified the ongoing challenge of antimicrobial resistance (AMR), a major public health threat causing millions of deaths annually. The pandemic led to a marked rise in AMR, particularly among Gram-negative bacteria in hospital settings.

A study at the University General Hospital of Alexandroupolis, Greece, from 2018 to 2022, reported a significant increase in resistant Gram-negative bacteria in intensive care units (ICUs). In the United States, the Centers for Disease Control and Prevention (CDC) noted a reversal of progress in combating AMR in 2020, with over 29,400 deaths attributed to healthcare-associated antimicrobial-resistant infections, nearly 40% of which were hospital-acquired. The European Centre for Disease Prevention and Control (ECDC) also reported a rise in AMR across Europe, highlighting the global scope of the issue (1).

Several bacterial pathogens exhibited heightened resistance during the pandemic, complicating treatment and increasing mortality risks:

1. *Acinetobacter baumannii*: Non-susceptibility to carbapenems in ICUs increased from 92.6% in 2018 to 97.9% in 2022 at the University General Hospital of Alexandroupolis. Resistance to amikacin rose from 81.6% to 93.4% during the same period. A 78% increase in carbapenem-resistant *A. baumannii* since 2019 was reported, posing severe challenges due to limited treatment options and high mortality rates in bloodstream infections.

2. *Klebsiella pneumoniae*: Resistance to colistin in ICUs grew from 58.3% in 2019 to 71.8% in 2022, and to meropenem from 79.8% to 92.4%. Carbapenem-resistant *Enterobacterales*, including *K. pneumoniae*, increased by 35%, often leading to prolonged hospital stays and higher mortality (2).

3. *Pseudomonas aeruginosa*: Non-susceptibility to meropenem in ICUs rose from 43.5% in 2018 to 53.6% in 2022, with amikacin non-susceptibility increasing from 41.3% to 53.6%. These trends complicate the treatment of ventilator-associated pneumonia.

4. *Enterococcus faecium*: Vancomycin non-susceptibility in hospital wards increased from 33.5% to 44.6% in 2022, contributing to higher treatment failures.

5. *Staphylococcus aureus*: Methicillin non-susceptibility in wards rose to 38.6% during the pandemic, reversing prior declines and increasing risks of severe infections like sepsis (3).

Hospital-acquired infections (HAIs), particularly those involving resistant pathogens, surged during the pandemic. U.S. hospitals reported a 15% increase in resistant hospital-onset infections and deaths from 2019 to 2020 across seven pathogens. A 2021 CDC analysis found significantly higher rates for four of six HAI types in 2020, many involving antibiotic-resistant bacteria. In a Malaysian hospital, Gram-negative bacilli (e.g., *K. pneumoniae*, *Escherichia coli*, and *P. aeruginosa*) were the primary causes of HAIs, with ICU respiratory infections rising notably. The incidence of HAIs among COVID-19

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patients was 4.64 per 1,000 hospitalization days, with clinically defined pneumonia being the most common (4).

While hospitals, particularly ICUs, were heavily impacted, AMR also increased in community and long-term care settings. Community-acquired resistant infections rose due to increased outpatient antibiotic prescribing, often for suspected but unconfirmed bacterial infections in COVID-19 patients. Long-term care facilities faced challenges with infection control due to staffing shortages and high patient turnover, contributing to the spread of resistant pathogens like methicillin-resistant *S. aureus* (MRSA). These settings are critical, as resistant bacteria can spread from communities to hospitals, amplifying the AMR crisis (5).

Several factors drove the rise in AMR during the pandemic:

1. Increased antibiotic use: Approximately 80% of hospitalized COVID-19 patients received antibiotics from March to October 2020, despite low rates of bacterial co-infection. Ceftriaxone, often paired with azithromycin, was commonly prescribed due to difficulties distinguishing COVID-19 from bacterial pneumonia. Overuse of broad-spectrum antibiotics fueled resistance development.

2. Healthcare system strain: Staff shortages, extended patient stays, and PPE shortages compromised infection control practices, creating environments conducive to the spread of resistant bacteria.

3. Reduced surveillance: The CDC's AMR Laboratory Network received 23% fewer specimens in 2020 compared to 2019, hindering AMR detection and response (6).

Efforts to combat AMR during the pandemic included enhanced infection prevention training, improved surveillance, and optimized antibiotic prescribing. For example, the CDC supported training programs for healthcare workers to improve hand hygiene and PPE use, reducing HAI rates in some facilities by up to 20%. The World Health Organization (WHO)'s Global Antimicrobial Resistance Surveillance System (GLASS) expanded data collection to track resistance trends, aiding targeted interventions. Antibiotic stewardship programs, such as those requiring pre-approval for broad-spectrum antibiotics, reduced inappropriate prescribing by 15% in participating U.S. hospitals. However, these efforts were inconsistent globally, and AMR rates continued to rise in many regions. Increased hand hygiene adherence during the pandemic may have contributed to a decline in some HAIs, such as central line-associated bloodstream infections, in specific settings (3).

Informative for Health Professionals

Health professionals must prioritize rapid diagnostic tools to differentiate viral and bacterial infections, reducing unnecessary antibiotic prescriptions. Implementing point-of-care tests, such as procalcitonin-guided algorithms, can guide antibiotic use, as studies have shown a 20 - 30% reduction in inappropriate prescribing in ICUs (3). Regular training on infection prevention, including strict adherence to hand hygiene and PPE protocols, is critical to curb HAIs. Additionally, health professionals should advocate for and participate in local antibiotic stewardship programs, ensuring pre-approval systems for broad-spectrum antibiotics are in place to limit resistance development (1).

Conclusions

The COVID-19 pandemic amplified AMR, particularly in hospital ICUs, but also in community and long-term care settings, driven by excessive antibiotic use, healthcare system strain, and weakened surveillance. Pathogens like *A. baumannii* and *K. pneumoniae* exhibited alarming resistance trends, increasing mortality and treatment challenges. Targeted interventions, such as rapid diagnostics, enhanced infection control training, and robust antibiotic stewardship, are critical to reversing these trends. Health professionals must adopt these evidence-based strategies, supported by data from WHO, CDC, and ECDC, to mitigate the AMR crisis and prevent further setbacks in patient outcomes.

Footnotes

Authors' Contribution: Study concept and design: R. A. and H. A.; Acquisition of data: R. A.; Analysis and interpretation of data: R. A. and H. A.; Drafting of the manuscript: R. A.; Critical revision of the manuscript for important intellectual content: R. A.; Statistical analysis: R. A. and H. A.; Administrative, technical, and material support: R. A. and H. A.; Study supervision: R. A.

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