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EDITORIAL

# The Pandemic's Unseen Legacy: How COVID-19 Transformed Hospitals into Incubators of Resistance?



**Abdurraouf Zaet,** *BSc, MSc, PhD*
Assistant Professor
University of Zawia,
Libya

When the World Health Organization declared COVID-19 a global health emergency in March 2020, healthcare systems worldwide mobilized to combat a novel viral threat. Yet beneath the surface of this viral crisis, another epidemic was gathering momentum one that will outlast the pandemic itself. In intensive care units where ventilators hummed and personal protective equipment grew scarce, bacteria were evolving. By 2020, resistant hospital-onset infections and deaths had surged by at least 15% across seven major pathogens in U.S. hospitals, with *Candida auris* increasing by 60% overall.[1] The irony is stark: our efforts to contain a viral pandemic inadvertently dismantled the very antimicrobial stewardship programs and infection controls that had kept bacterial resistance in check for decades.

The relationship between COVID-19 and antimicrobial resistance operates through multiple interconnected pathways. First, empirical antibiotic prescribing reached unprecedented levels during the pandemic, despite COVID-19's viral etiology. A comprehensive analysis of 513,698 COVID-19 hospitalizations across 803 U.S. acute care facilities revealed that over 80% of patients received antibiotics during the first five days of admission in the early pandemic period.[2] This prescribing occurred even though bacterial co-infection rates at admission ranged only from 7.6% to 16%.[2,3] The mismatch between antibiotic exposure and documented infection created intense selection pressure for resistant organisms. Critically, antibiotic exposure remained independently associated with higher odds of secondary infection and adverse clinical outcomes after adjustment for demographic factors, comorbidities, COVID-19 severity, and hospitalization duration.

Second, antimicrobial stewardship programs faced systematic disruption. Research involving key informants across U.S. healthcare facilities found that some institutions reported complete suspension of stewardship activities as resources were diverted to pandemic response.[4] One physician informant noted that everything switched to COVID, with medical leadership charged with managing the COVID response for entire communities. Even where stewardship programs continued, staffing shortages and virtual communication platforms degraded their effectiveness. Pharmacists reported that antimicrobial stewardship took a significant hit when personnel were taken off-site and that online stewardship communication was not as effective or robust as needed, especially during a crisis.[5]

Third, infection prevention and control infrastructure collapsed under pandemic pressure. A national survey of 1,081 infection preventionists in fall 2020 found that 25% lacked sufficient disinfection supplies, N95 respirators, isolation gowns, and gloves, while 10-20% lacked eye protection and hand hygiene supplies.[1] These shortages forced implementation of crisis standards of care, including respirator reuse in nearly two-thirds of facilities and isolation gown reuse in one-third. The consequences extended beyond COVID-19 transmission: extended use of underlayers of personal protective equipment was associated with outbreaks of Candida auris, a multidrug-resistant organism.[1]

The psychological toll on healthcare workers directly influenced antibiotic prescribing patterns. Key informants described underlying fear of not doing enough for patients and noted that patients kept dying, which perpetuated the use of antibiotics just in case resistant pathogens were present. This moral distress led to defensive prescribing practices that prioritized immediate patient safety over long-term resistance containment. The pandemic also exposed fundamental vulnerabilities in how healthcare systems provision essential protective resources.

Analysis of supply chains revealed that market mechanisms failed to align private incentives with public

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health needs, leaving hospitals dependent on crisis standards when demand surged.

The empirical evidence for pandemic-driven resistance is robust and troubling. A systematic review and meta-analysis by Langford and colleagues documented that over 70% of COVID-19 patients received antibiotics despite low bacterial coinfection rates, with significant increases in resistant healthcare-associated infections.[6] In European tertiary care centers, Acinetobacter species developed multidrug resistance rates of 97% during the pandemic period, while Klebsiella pneumoniae resistance exceeded 80% in post-COVID years. Carbapenem resistance in Pseudomonas species increased, and extended-spectrum β-lactamase resistance in Klebsiella rose as well (6). These were not transient disruptions. Hospital-onset resistant infections and deaths increased by at least 15% from 2019 to 2020.[1] Most concerning, resistant infections remained elevated above pre-pandemic baselines in 2022, indicating that the pandemic's impact on resistance was structural rather than merely acute.[1]

The post-COVID era demands fundamental restructuring of antimicrobial stewardship and infection prevention. Stewardship programs must be designated as essential infrastructure, not discretionary programs vulnerable to diversion during emergencies. Diagnostic stewardship must be prioritized. The pandemic demonstrated that empirical prescribing in the absence of rapid diagnostics drives resistance.[3] Investment in point-of-care testing and molecular diagnostics can enable targeted therapy, reducing unnecessary antibiotic exposure. Pandemic preparedness planning must integrate antimicrobial resistance containment, including maintaining surveillance systems during emergencies, ensuring supply chains for diagnostics and therapeutics, and protecting healthcare workforce mental health to prevent burnout-driven prescribing.

The COVID-19 pandemic will be remembered as a defining global health catastrophe. But its legacy includes a quieter, more insidious crisis: the acceleration of antimicrobial resistance that threatens to render common infections untreatable. The data are unambiguous resistant infections surged during the pandemic and remain elevated. The mechanisms are understood empiric antibiotic overuse, stewardship program disruption, and infection control breakdown. The solutions are known strengthened diagnostics, protected stewardship infrastructure, and resilient supply chains. What remains is the political will to implement these solutions before the post-COVID resistance crisis becomes the next pandemic. Unlike

Unlike COVID-19, bacterial resistance offers no prospect of vaccine-induced resolution. The time to act is now, before the incubators of resistance that COVID-19 created become permanent features of our healthcare landscape.

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