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Beyond the Plan: A Narrative Review of Multi-Professional Infection Prevention and Control Resilience for Emerging Respiratory Pathogens

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Abstract

Background: The COVID-19 pandemic exposed critical fissures in traditional, siloed infection prevention and control (IPC) frameworks, which were often hospital-centric and ill-equipped for a sustained, society-wide respiratory threat. The post-pandemic era demands a paradigm shift from static preparedness plans to dynamic, integrated resilience—the capacity of the health system to anticipate, absorb, adapt, and transform in the face of novel pathogens.

Aim: This narrative review aims to synthesize evidence from the COVID-19 response to propose a model of multi-professional IPC resilience.

Methods: A systematic search was conducted across PubMed, Scopus, and Web of Science for English-language literature (2010-2024).

Results: The review identifies four pillars of multi-professional resilience: 1) Integrated Sentinel Surveillance, leveraging community healthcare points for early signal detection; 2) Decentralized Mass Vaccination/Therapeutics, orchestrated by pharmacy and nursing networks; 3) Universal Respiratory Precautions, with dentistry leading on aerosol risk mitigation; and 4) Unified Communication & Trust-Building. Fragmented data systems, supply chain fragility, professional scope-of-practice barriers, and misinformation were key vulnerabilities identified.

Conclusion: Resilience to future respiratory pandemics requires intentional, pre-crisis integration of community-based healthcare assets—pharmacies, dental clinics, and primary care—into a unified public health infrastructure. Moving beyond hospital-focused plans to a whole-of-society strategy, built on shared protocols, interoperable data, and reciprocal trust among professions and the public, is the paramount lesson of COVID-19.

Keywords: Infection Prevention Resilience; Multi-professional Collaboration; Pandemic Preparedness; Sentinel Surveillance; Health System Integration.

Introduction

The global confrontation with SARS-CoV-2 was more than a virological challenge; it was a profound stress test of our infection prevention and control (IPC) paradigms (Yin et al., 2022). While plans existed, many systems demonstrated fragility rather than resilience, characterized by hospital overload, fragmented public health communication, supply chain collapses, and a stark inability to mobilize community-based healthcare assets cohesively (Khan et al., 2018). Traditional IPC has often been compartmentalized—expertise concentrated within hospital epidemiology departments, with public health agencies operating in parallel, and community-based health professionals (pharmacists, dentists, primary care nurses) engaged reactively, if at all (Baker et al., 2020). This siloed approach proved inadequate for a pathogen that transcended all care settings and required a whole-of-society response (Free et al., 2022).

The concept of resilience, borrowed from ecology and engineering, offers a more robust framework for post-pandemic preparedness. In a health system context, resilience is defined as the capacity to prepare for, manage (absorb and adapt), and learn from shocks to maintain core functions and

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ultimately improve (Thomas et al., 2020). For IPC, this means moving beyond static "binders on a shelf" to dynamic, interconnected systems that can scale and flex. The COVID-19 experience underscored that resilience is not inherent to any single profession but emerges from the integration of their complementary strengths (Blanchet et al., 2022). Community pharmacies provided critical diagnostic and vaccination access points; dental professionals grappled with high-risk aerosol-generating procedures (AGPs) and could serve as early outbreak detectors; nurses sustained both institutional and community care under extreme duress; and public health agencies struggled to synthesize data from disparate sources (Poroes et al., 2023).

This narrative review synthesizes the hard-won lessons of the recent pandemic to construct a model for multi-professional IPC resilience against future respiratory pathogens. It argues that future preparedness must be built on pre-emptive, trust-based collaboration across five key domains: infection control, public health, pharmacy, nursing, and dentistry. By analyzing strategies for integrated surveillance, decentralized countermeasure distribution, universal precaution adoption, and coherent communication, this review provides a blueprint for transforming a collection of professional silos into a resilient, responsive ecosystem capable of meeting the next airborne threat with agility and unity.

Integrated, Community-Embedded Surveillance and Situational Awareness

A resilient system detects threats early and tracks their spread with precision. The pandemic revealed the fatal lag in traditional, lab-centric surveillance and the inefficiency of manual contact tracing at scale. Future readiness depends on creating an agile, integrated surveillance network that turns every community healthcare encounter into a potential data node. Figure 1 illustrates the four interdependent pillars of multi-professional IPC resilience derived from COVID-19 response lessons.

The Role of Public Health & Infection Control

Public health agencies must evolve into hubs for real-time data fusion, moving from being primary data collectors to being sophisticated interpreters of integrated data streams (Kamalrathne et al., 2023). This requires investment in interoperable health information technology that can securely amalgamate electronic health record (EHR) data from hospitals, positive test results from pharmacies, syndromic surveillance (e.g., influenza-like illness) from primary care and dental clinics, and even anonymized mobility data (Shakeri Hossein Abad et al., 2021). Infection Control (IC) teams within hospitals are crucial sentinels for novel pathogen emergence, particularly from international travelers or in intensive care units (ICUs) managing severe respiratory failure. Their early warnings must trigger automated, secure data-sharing protocols with public health, moving beyond phone calls and faxes to application programming interface (API)-driven alerts (Maddah et al., 2023).

Figure 1. Multi-Professional Infection Prevention and Control (IPC) Resilience Framework for Emerging Respiratory Pathogens

Activating Community-Based Sentinels

Community pharmacies and dental clinics are vastly underutilized assets in the surveillance landscape. Pharmacies, visited by millions weekly, can contribute to syndromic surveillance by reporting spikes in over-the-counter sales of cough suppressants, antipyretics, and thermometers—an early signal of community respiratory illness (Lindell et al., 2018). During COVID-19, pharmacies became primary sites for diagnostic testing, generating vast amounts of real-time, geographically precise data. Integrating these point-of-care test results directly into public health dashboards is a resilience imperative (Wulandari et al., 2021).

Dental professionals, due to the nature of their work, are at high risk for exposure to respiratory pathogens and may be among the first to encounter infected, pre-symptomatic individuals (Sabino-Silva et al., 2020). Furthermore, patients may present for urgent dental care before seeking general medical attention. Establishing simple, standardized protocols for dental teams to report clusters of patients with acute respiratory symptoms or confirmed infections to local public health departments could provide invaluable early warning of community spread, positioning dental clinics as a novel sentinel network (Sharma et al., 2020).

The synergy here is clear: Public health provides the analytical platform, infection control offers the institutional alarm bell, and pharmacy/dental networks provide the granular, community-level data that creates a high-resolution picture of outbreak dynamics (Gould et al., 2019). This integrated model facilitates faster containment, more precise resource allocation, and proactive,

rather than reactive, public health measures (Table 1). Figure 2 depicts an integrated, community-embedded IPC response pathway.

Table 1: Multi-Professional Roles in an Integrated Surveillance and Response Framework

Professional Domain	Core Surveillance Function	Response & Mitigation Role	Key Interoperability Need
Public Health	Data aggregation, analysis, and outbreak declaration; genomic sequencing coordination.	Coordinate population-level interventions (isolation/quarantine guidelines, community masking advisories).	Secure, bidirectional data exchange platforms with all healthcare sectors.
Infection Control (Hospital)	Early detection of novel/severe cases within healthcare facilities; monitoring HCW infection rates.	Implement and adjust facility-specific transmission-based precautions; manage HCW exposure/return-to-work.	Real-time linkage to public health dashboards; protocols for communicating with community partners.
Pharmacy	Syndromic surveillance via OTC medication sales; reporting point-of-care test results.	Mass distribution of antivirals, monoclonal antibodies, and vaccines; public education on self-care.	Integration of diagnostic test results into public health databases; access to prescription records for risk stratification.
Dentistry	Sentinel reporting of patients with respiratory symptoms seeking dental care; monitoring AGP-related transmission risk.	Implementation of enhanced environmental controls (ventilation, fallow time); patient triage and pre-appointment screening.	Direct, simple reporting pathways to local public health; access to community transmission-level data to guide precaution levels.
Nursing (Community/Public Health)	Frontline symptom assessment during home visits, school screenings, and vaccination clinics.	Case investigation, contact tracing, patient education, and monitoring of home-isolated cases.	Mobile data entry tools linked to central databases; clear communication channels with IC and pharmacy regarding patient status.

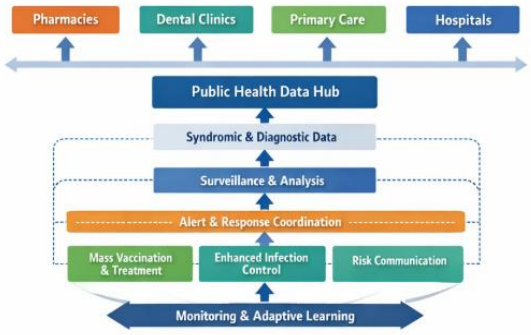

Figure 2. Community-Embedded, Multi-Professional IPC Response Pathway During a Respiratory Pandemic

Decentralized Logistics for Mass Prophylaxis and Treatment

The scramble for vaccines, antivirals, and personal protective equipment (PPE) highlighted profound supply chain and distribution vulnerabilities. Resilience requires pre-established, ethically grounded networks for the rapid and equitable mass distribution of medical countermeasures, leveraging the extensive reach of pharmacy and nursing.

The Logistics and Ethics of Distribution

The successful mass vaccination campaign against COVID-19 was, in large part, a testament to the mobilization of community pharmacies and nursing teams (Baroy et al., 2016). Pharmacists' accessibility, medication expertise, and existing cold-chain infrastructure made them indispensable (Romero-Mancilla et al., 2023). Future frameworks must permanently embed pharmacists in vaccine planning committees and grant them sustained authority to order and administer vaccines across the lifespan (Perman et al., 2018). This extends to the distribution of oral antivirals, which could be initiated via pharmacist-led test-to-treat programs, drastically reducing the time between diagnosis and therapy (O'Sullivan et al., 2022).

The ethical dimension is paramount. Pharmacists and public health nurses, working in concert, must be equipped with clear, evidence-based frameworks for allocating scarce resources during the initial phases of a pandemic (Dowling et al., 2022). This includes not only vaccines and therapeutics but also PPE and diagnostics. Principles of equity, reciprocity (prioritizing frontline workers), and maximizing benefit must be operationalized into actionable distribution algorithms that are transparent and publicly communicated (Emanuel et al., 2020).

Nurses, particularly in public health and school-based roles, are critical for reaching homebound, rural, and vaccine-hesitant populations through mobile clinics and targeted community engagement, ensuring equity is not an afterthought but a design principle (AlShurman & Butt, 2023; Strully et al., 2021).

Supply Chain Integrity and Allocation Governance

While pharmacy and nursing handle the "last mile" of distribution, infection control and public health must ensure the integrity of the supply chain and provide ethical oversight. Hospital IC teams are experts in PPE conservation strategies and can guide community partners on safe reuse and decontamination protocols during shortages. Public health agencies must maintain strategic national stockpiles with rotating inventories and diversified suppliers to avoid single-point failures. They also bear the responsibility for setting transparent, population-level allocation guidelines that prevent harmful competition between hospitals, clinics, and pharmacies.

This pillar's resilience is built on a clear, pre-negotiated chain of command and logistics: public health secures and allocates bulk supplies based on ethical frameworks; pharmacy networks provide high-throughput, accessible distribution points; and nursing extends reach into the community's furthest corners. This decentralized model reduces burden on hospitals, accelerates population coverage, and builds equity into the response architecture from the outset.

Universal Adoption of Enhanced Respiratory Precautions and Environmental Controls

SARS-CoV-2 transmission through aerosols necessitated a re-evaluation of long-standing IPC practices across all settings. Resilience requires the universal adoption of a higher baseline—"Universal Respiratory Precautions"—and the ability to seamlessly escalate protections based on community transmission levels.

Leading on Aerosol Risk Mitigation

No clinical setting grapples more directly with respiratory aerosols than dentistry. The pandemic forced a rapid evolution in dental IPC, offering a model for other sectors (Singh et al., 2022). Key adaptations included rigorous pre-appointment screening, the use of high-volume evacuators and rubber dams to minimize aerosol spread, and significant investment in environmental controls—specifically, improving ventilation rates and implementing air filtration (e.g., HEPA units) in operatories (Beltrán et al., 2023). The concept of a "fallow period" between patients to allow for aerosol clearance, while debated, underscored the seriousness of airborne risk. Dentistry's experience provides critical, evidence-based protocols for managing AGPs that can be adapted for other medical procedures generating aerosols (bronchoscopy, ENT surgery) (Eggmann et al., 2021). Furthermore, dental clinics' routine use of respirators (N95/KN95) and face shields sets a standard for prolonged, close-contact encounters with unmasked patients (Peres et al., 2021).

Cross-Professional Standardization and Escalation

A resilient system cannot have different respiratory precaution standards in a hospital ER, a pharmacy counter, and a dental chair when facing the same community threat. Infection control professionals, in collaboration with public health, must lead the development of a tiered precaution framework (Chen et al., 2023). This framework would define a minimum "enhanced droplet/airborne baseline" for all patient-facing interactions during a respiratory pandemic and establish clear triggers for escalating to higher levels of protection (e.g., routine respirator use, mandatory eye protection) based on local transmission metrics (Bahl et al., 2022). This ensures consistent protection for healthcare workers (HCWs) and patients across the continuum and prevents confusion.

Nursing and pharmacy professionals, who often interact with potentially infected individuals in less controlled environments (clinic rooms, pharmacy counters, drive-through sites), must be included in the development and training for these standardized protocols. Their frontline perspective is essential for ensuring guidelines are practical and implementable. Cross-training between professions on proper respirator fit-testing and donning/doffing procedures builds a deeper, shared culture of safety.

Unified Communication, Trust, and Psychological Resilience

Perhaps the most profound lesson of COVID-19 was that technical solutions fail without trust and clear communication. Misinformation, public confusion, and HCW burnout became parallel pandemics, eroding the social license for effective interventions (Table 2).

Combating Misinformation with a Unified Voice

A cacophony of conflicting messages from different professional bodies, political leaders, and media sources fueled public distrust. Multi-professional resilience requires a pre-established communication coalition (Fridman et al., 2023). Public health agencies should lead, but messages on topics like vaccine safety, mask efficacy, and isolation guidelines must be co-developed and endorsed by trusted professional associations representing pharmacists, nurses, dentists, and physicians (Southwell et al., 2023). When a pediatrician, a community pharmacist, and a public health nurse deliver the same, clear message, it carries exponentially more weight. Social listening tools can help this coalition identify emerging misinformation narratives and rapidly deploy counter-messaging through the vast networks of community-based professionals (Lewis et al., 2021).

Building HCW Support and Psychological Safety

The pandemic's toll on HCWs was immense. Resilience is impossible with a depleted and traumatized workforce (Hegarty et al., 2022). Systems must invest in the psychological safety and support of all HCWs. This includes ensuring adequate staffing ratios (a key nursing concern), providing mental health resources, and creating non-punitive sick leave policies that encourage symptomatic staff to stay home—a critical infection control measure itself (Greenberg et al., 2020). Furthermore, involving frontline staff from all professions in the development of crisis protocols fosters ownership and reduces moral injury. When nurses, pharmacists, and dental assistants have a voice in the policies that govern their risk, trust in leadership and institutional resilience grows (Scott et al., 2023).

Table 2: Barriers and Enablers to Multi-Professional IPC Resilience

Domain	Key Barriers Identified (COVID-19 Lessons)	Essential Enablers for Future Resilience
Structural & Systemic	• Fragmented health data systems lacking interoperability. • Just-in-time supply chains vulnerable to global disruption. • Rigid professional scopes of practice hindering role flexibility. • Inadequate pre-pandemic investment in public health infrastructure.	• Investment in interoperable health data exchanges (APIs, FHIR standards). • Diversified, strategic national stockpiles with "warm" manufacturing bases. • Permanent legislative changes enabling pharmacist vaccine/admin authority and nurse-led initiatives. • Sustained, baseline funding for public health workforce and digital infrastructure.
Operational & Clinical	• Inconsistent IPC protocols across community and acute care settings. • Lack of cross-training in respirator use and AGP management for non-hospital staff. • Inefficient, manual processes for surveillance and contact tracing.	• Development of tiered, "transmission-level" IPC guidelines applicable to all healthcare settings. • Joint simulation exercises and training for pharmacy, dental, and nursing staff on respiratory outbreaks. • Automation of data reporting and deployment of digital tools for case management.
Sociocultural & Communication	• Proliferation of misinformation eroding public trust. • Inconsistent messaging from different authorities and professions. • HCW burnout, moral injury, and lack of psychological support systems. • Equity gaps in access to testing, treatment, and vaccines.	• Establishment of multi-professional communication coalitions for unified messaging. • Proactive, transparent public communication campaigns co-delivered by trusted community HCWs. • Institutional commitment to HCW mental health, safe staffing, and participatory policy design. • Embedding equity frameworks into all logistics and distribution plans from the outset.

Conclusion

The COVID-19 pandemic was a tragic but instructive rehearsal for future, and perhaps more severe, respiratory pandemics. It demonstrated conclusively that resilience cannot be housed within any single institution or profession. The path forward requires a deliberate dismantling of the pre-pandemic silos that hampered our response. As this review has outlined, resilience is a multi-faceted construct built on four interdependent pillars: integrated surveillance that sees the community through a thousand eyes; decentralized logistics that deliver hope swiftly and justly; universal precautions that protect every caregiver and patient; and unified communication that fortifies the public's trust.

The central thesis is that the community healthcare infrastructure—the network of pharmacies, dental clinics, primary care offices, and public health nursing services—must no longer be an afterthought in pandemic planning. It must be the frontline, fully integrated, digitally connected, and operationally empowered. This requires proactive investment in interoperable data systems, permanent legal and regulatory changes to optimize scopes of practice, and the creation of standing multidisciplinary committees that plan, train, and exercise together in peacetime.

The goal is not merely to survive the next shock, but to adapt and transform through it. By leveraging the unique strengths of infection control, public health, pharmacy, nursing, and dentistry in a cohesive framework, we can move from a defensive posture of *preparedness* to a proactive capacity for *resilience*. This means building a system where a signal in a dental clinic triggers a alert in a public health command center; where a vaccine shipped from a national stockpile is seamlessly administered by a pharmacist the next day; where a nurse, a dentist, and a physician all share the same evidence-based guidance with their patients; and where every healthcare worker feels protected, supported, and heard. This is the resilient, integrated health

ecosystem we must now construct, not in response to the last pandemic, but in anticipation of the next.

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