



Nurse Leadership in Infection Control During Healthcare Crises

Glory Ohunyon^{1*}, Prisca U Ojukwu², Moshood Ayinde³

¹ Independent Researcher, UK

² Nnamdi Azikiwe University, Nigeria

³ Sanya Clinic, Nigeria

* Corresponding Author: **Glory Ohunyon**

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Abstract

Healthcare crises, particularly those driven by infectious disease outbreaks, exert profound pressure on health systems and highlight the essential role of robust infection prevention and control measures. This review explores the critical contribution of nurse leadership in influencing infection control outcomes during such crises, aiming to synthesise evidence on leadership roles, operational challenges, enabling conditions, and future directions for policy, practice, and research. A narrative review methodology was employed, integrating insights from interdisciplinary literature on nursing leadership, infection control, crisis response, and health system innovation.

The analysis indicates that nurse leaders function as key coordinators of infection control activities, bridging policy and practice while maintaining workforce cohesion in uncertain environments. Central leadership functions include rapid decision-making, effective communication, multidisciplinary collaboration, resource allocation, and the reinforcement of a culture of safety. Nonetheless, the review identifies persistent challenges such as limited resources, staff exhaustion, fragmented infrastructures, and inconsistencies in leadership preparedness. Conversely, factors such as ongoing professional development, supportive governance structures, technological integration, and adaptive leadership approaches were found to strengthen nurse-led infection control efforts.

Furthermore, the review emphasises the increasing relevance of digital innovations, including telehealth and data-driven decision-support systems, in enhancing leadership effectiveness and organisational responsiveness. It concludes that infection control success during healthcare crises is fundamentally dependent on strong and well-supported nurse leadership.

Recommendations focus on expanding leadership training initiatives, embedding nurse leaders within strategic decision-making processes, improving digital literacy, and promoting research that links leadership practices to measurable outcomes. These actions are vital for fostering resilient and responsive healthcare systems prepared for future crises.

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1. Introduction

Healthcare crises, particularly infectious disease outbreaks, place extraordinary pressure on health systems by simultaneously increasing demand for care, destabilising routine service delivery, and intensifying the risk of pathogen transmission within clinical environments. Under such conditions, infection prevention and control become not merely a technical function, but a strategic pillar of organisational survival, workforce protection, and patient safety. The centrality of nurses within this landscape is unmistakable. As the largest professional group in the health workforce and the cadre most continuously present across patient pathways, nurses occupy a uniquely influential position in translating infection control policy into everyday practice, especially during emergencies marked by uncertainty, speed, and operational strain (Lam *et al.*, 2018; Guilamo-Ramos *et al.*, 2021). For this reason, any serious examination of infection control during healthcare crises must place nurse leadership at the forefront of

analysis the contemporary healthcare crisis environment has demonstrated that outbreaks do not only challenge clinical capacity; they also expose structural weaknesses in preparedness, communication, coordination, and leadership. Loveday and Wilson (2021) argue that pandemic preparedness must be understood as an ongoing learning process rather than a static compliance exercise, particularly in relation to infection prevention and control systems. Their position is significant because it reframes crisis readiness as an institutional capability requiring leadership, adaptation, and sustained organisational learning. In practical terms, this means that nurse leaders are not only expected to enforce protocols, but also to interpret rapidly evolving guidance, align teams around safe practice, and maintain continuity of care under volatile conditions. Such expectations expand the scope of nursing leadership beyond supervision into systems stewardship.

The importance of this leadership role became especially visible during recent large-scale public health emergencies, where nurses worked at the intersection of patient care, workforce coordination, community trust, and operational response. Guilamo-Ramos *et al.* (2021) emphasise that nurses have consistently been at the frontline of public health emergency preparedness and response, drawing on lessons from HIV/AIDS and emerging infectious disease outbreaks to show that nursing contributions extend well beyond bedside tasks. Their analysis suggests that nurses serve as key agents in surveillance, education, risk communication, prevention, and service continuity. This broader framing is highly relevant to infection control during crises because it highlights leadership as both relational and infrastructural: nurses influence outcomes not only through direct care, but through their capacity to mobilise teams, interpret evidence, and sustain public health action in difficult conditions.

At the same time, the literature shows that preparedness for infectious crises has not always matched the scale of expectations placed upon nurses. Lam *et al.* (2018), in their review of qualitative evidence on nurses' preparedness for infectious disease outbreaks, identify recurring concerns relating to inadequate training, insufficient institutional support, unclear communication, emotional burden, and perceived personal risk. These findings are especially important for a review on nurse leadership because they indicate that effective infection control is inseparable from workforce readiness. A nurse leader may be responsible for implementation, but implementation is weakened when frontline staff feel underprepared, unsupported, or unsafe. Thus, preparedness is not simply an individual competency issue; it is a leadership and organisational issue that shapes whether infection control measures are consistently enacted under pressure.

Relatedly, leadership during crises is distinguished by the need to act decisively in environments where information changes rapidly and resources may be constrained. Shuman and Costa (2020) describe the competencies required of intensive care unit nursing leaders during disasters, emergencies, and outbreaks, highlighting the necessity of stepping into clinical uncertainty, stepping up to coordinate response efforts, and stepping out to think strategically across systems. Their framework is particularly useful because it captures the multidimensional nature of nursing leadership in crises. Infection control during emergencies requires not only technical knowledge of isolation, transmission precautions, and workflow redesign, but also situational judgement,

communication skill, team coordination, and the capacity to balance immediate clinical pressures with longer-term organisational safety.

This multidimensional demand is echoed by Hopkinson and Jennings (2021), who highlight essential areas of nurse leader expertise for pandemic management. Their work reinforces the view that pandemic leadership requires more than operational control; it requires foresight, adaptability, prioritisation, and the ability to integrate people, processes, and information into coherent action. In infection control terms, this translates into leading PPE stewardship, ensuring adherence to protective measures, coordinating staff deployment, maintaining morale, and sustaining trust across interdisciplinary teams. Such responsibilities position nurse leaders as critical mediators between policy and practice, particularly when formal guidance must be translated rapidly into feasible action within complex care environments.

The challenge becomes even more pronounced in settings with vulnerable populations and fragile infrastructures. Rubano, Kieffer and Larson (2022), in their environmental scan of infection prevention and control in nursing homes during COVID-19, illustrate how infection control breakdowns can be intensified by staffing instability, resource limitations, environmental constraints, and variable preparedness. Although nursing homes differ from acute care hospitals, the study is highly relevant because it shows that leadership in infection control must be context-sensitive. Nurse leaders working in crises must often adapt general IPC principles to highly specific institutional realities, including older infrastructure, workforce shortages, and high-risk populations. This reinforces the argument that effective nurse leadership is a decisive determinant of whether infection control policies become meaningful protective practice.

In addition, recent healthcare crises have accelerated the adoption of digital and system-level innovations that reshape how services are organised and how decisions are made. Omotayo and Kuponiyi (2020) show that post-COVID healthcare systems increasingly turned to telehealth as a mechanism for continuity of care, reduced exposure, and service adaptation. Although telehealth is not itself an infection control intervention in the narrow sense, its expansion reflects a broader transformation in crisis response: infection risk management now intersects with digital service redesign, remote coordination, and alternative care pathways. For nurse leaders, this implies a growing responsibility to navigate hybrid models of care while preserving safety, communication quality, and clinical oversight.

Similarly, Tafirenyika *et al.* (2023) underscore the growing importance of AI-driven business intelligence tools for strategic decision-making in public health agencies. Their emphasis on rapid, data-informed response is relevant to healthcare crises because infection control increasingly depends on timely information, trend recognition, and responsive leadership decisions. Nurse leaders do not operate in informational vacuums; they work within systems that increasingly rely on dashboards, surveillance signals, workforce metrics, and operational intelligence. As crises become more complex, the ability to interpret and act on such information may become an increasingly important dimension of infection control leadership.

Despite these developments, evidence suggests that nurse leader preparation for disasters remains uneven. Reedy *et al.* (2022) found important gaps in disaster preparation among

nurse leaders, indicating that formal leadership readiness cannot be assumed even when nurses are expected to direct crisis operations. This finding is particularly significant because it reveals a tension at the heart of healthcare crisis management: nurse leaders are indispensable to infection control, yet their preparation may be inconsistent across institutions. As a result, strengthening nurse leadership must be seen as a strategic imperative for crisis resilience rather than an optional professional enhancement.

Nurse leadership in infection control during healthcare crises is both indispensable and insufficiently supported. Nurses are central to preparedness, implementation, coordination, and adaptation, yet their effectiveness depends heavily on training, organisational support, context-sensitive systems, and access to timely information (Lam *et al.*, 2018; Reedy *et al.*, 2022). This review therefore proceeds from the premise that infection control during crises is not only a matter of protocols and resources, but also one of leadership capacity. Understanding how nurse leaders shape infection control efforts is essential for improving patient safety, workforce protection, and health-system resilience in future emergencies.

1.1. Background and Context of Healthcare Crises

Healthcare crises have become defining tests of institutional resilience, clinical coordination, and professional leadership. Whether triggered by pandemics, epidemics, humanitarian emergencies, or rapidly escalating hospital outbreaks, such crises disrupt routine service delivery while simultaneously intensifying the demand for safe, timely, and adaptable care. Their significance lies not only in the scale of morbidity and mortality they may generate, but also in the speed with which they expose weaknesses in preparedness, workforce capacity, communication systems, and infection prevention infrastructures. In these circumstances, infection control moves from being a specialised operational function to a central determinant of health-system continuity and public confidence.

The contemporary context of healthcare crises is characterised by volatility, uncertainty, and interdependence. A localized infection event can quickly evolve into a system-wide emergency affecting staffing, patient flow, resource availability, and the ethical allocation of care. Crises of this kind rarely remain confined to the clinical domain; they reshape organisational priorities, compel rapid policy adaptation, and require institutions to balance emergency responsiveness with the preservation of essential services. The resulting environment places sustained pressure on healthcare workers, particularly nurses, who remain continuously present at the point of care and are often the first to translate emergency directives into practical action.

Within this context, nurse leadership assumes critical importance. Nurse leaders operate at the intersection of clinical practice, workforce coordination, patient safety, and organisational governance. They are required to guide teams through evolving protocols, manage fear and uncertainty, uphold infection prevention standards, and sustain service delivery under exceptional strain. Their influence extends across hospitals, long-term care settings, community services, and public health systems, making them central actors in both immediate crisis response and longer-term recovery. Consequently, understanding the background and context of healthcare crises is essential to appreciating why nurse leadership in infection control has emerged as a

strategic priority in contemporary healthcare scholarship and practice.

1.2. Problem Statement and Rationale for the Review

Despite the acknowledged importance of infection prevention and control during healthcare crises, the leadership contribution of nurses remains insufficiently synthesised within the existing literature. Much of the available evidence focuses either on frontline nursing experiences, general emergency preparedness, or technical infection control measures, while comparatively less attention is given to the distinctive leadership roles nurses perform in coordinating, interpreting, and sustaining infection control under crisis conditions. This creates an important conceptual and practical gap. Infection control during a healthcare emergency is not achieved by protocols alone; it depends on leadership capable of transforming guidance into consistent action across complex and pressured care environments.

The problem is further compounded by the uneven preparedness of healthcare systems to support nurse leaders in such roles. Many organisations continue to confront recurring challenges including limited surge capacity, staffing instability, fragmented communication, rapidly changing guidelines, and insufficient integration of nursing leadership into strategic decision-making. These conditions can weaken implementation fidelity, undermine workforce confidence, and reduce the effectiveness of infection control efforts at precisely the moment they are most needed. The consequences are significant, affecting patient outcomes, occupational safety, service continuity, and institutional credibility.

The rationale for this review therefore lies in the need to consolidate knowledge on how nurse leadership shapes infection control during healthcare crises, what barriers constrain this leadership, and what enabling conditions support it. A focused review is justified because nurse leaders occupy a pivotal position between policy and practice, yet their contribution is often dispersed across diverse bodies of literature rather than examined as a coherent field of inquiry. By bringing together evidence from nursing, infection prevention, public health, and crisis management, this review seeks to clarify the strategic value of nurse leadership and provide a stronger foundation for practice improvement, leadership development, and health-system preparedness.

1.3. Aim, Objectives, and Review Questions

The overall aim of this review is to examine the role of nurse leadership in infection control during healthcare crises and to clarify how leadership practices influence preparedness, response effectiveness, workforce safety, and continuity of care. The review is founded on the premise that infection prevention and control during crises is not solely a matter of technical compliance, but also a leadership-dependent process shaped by decision-making, coordination, communication, and organisational culture. By focusing specifically on nurse leadership, the review intends to illuminate an area of practice that is central to crisis management but often under-theorised in the broader literature.

To achieve this aim, the review pursues several objectives. First, it seeks to identify the principal leadership roles assumed by nurses in the planning, implementation, and oversight of infection control measures during healthcare

crises. Second, it aims to explore the structural, organisational, and contextual factors that either enable or constrain effective nurse-led infection control. Third, it examines how nurse leadership contributes to key outcomes such as adherence to infection prevention measures, staff protection, interprofessional coordination, and service resilience. Fourth, it considers how emerging tools, institutional reforms, and leadership development strategies may strengthen nurse-led infection control in future crises. These objectives give rise to several guiding review questions. What leadership roles do nurses perform in relation to infection control during healthcare crises? How do nurse leaders influence the translation of infection control policies into frontline practice? What barriers most commonly hinder effective nurse-led infection control in crisis contexts? What organisational and professional conditions strengthen nurse leaders' capacity to coordinate safe and adaptive responses? Finally, what lessons can be drawn to inform future policy, practice, education, and research on nurse leadership in infection control during emergencies? Together, these questions provide a structured foundation for a review that is analytically focused and practically relevant.

1.4. Scope and Significance of the Review

This review is concerned with nurse leadership in infection control across a range of healthcare crises, including pandemics, epidemics, institutional outbreaks, and other emergency conditions in which transmissible disease poses a major threat to patient and workforce safety. Its scope encompasses diverse care settings, including acute care hospitals, intensive care units, long-term care facilities, community health services, and public health response environments. By adopting this broad perspective, the review recognises that healthcare crises are experienced differently across settings, yet share common leadership demands related to safety, coordination, adaptation, and accountability.

The review focuses specifically on leadership functions performed by nurses in relation to infection prevention and control. These include preparedness planning, protocol implementation, staff coordination, risk communication, compliance monitoring, outbreak response, and the maintenance of a culture of safety under pressure. Although the review acknowledges the importance of interdisciplinary collaboration, its principal emphasis remains on the nursing leadership dimension rather than on general organisational management. It also considers how contemporary developments such as digital health systems, real-time data tools, and changing care models may shape leadership practice in crisis contexts.

The significance of the review is both scholarly and practical. Scholarly, it contributes to a more coherent understanding of a fragmented area of evidence by connecting nursing leadership literature with infection control and crisis-response scholarship. Practically, it offers insights relevant to nurse managers, infection prevention specialists, hospital administrators, educators, and policymakers seeking to strengthen crisis readiness. By clarifying what effective nurse leadership looks like in infection control during emergencies, the review supports the development of more resilient systems, better protected workforces, and safer care environments. Its significance ultimately lies in advancing a leadership-centred understanding of infection control as a

critical component of healthcare crisis preparedness and response.

2. Conceptual and Theoretical Foundations of Nurse Leadership in Infection Control

The conceptual and theoretical foundations of nurse leadership in infection control during healthcare crises rest on the recognition that infection prevention is not solely a technical or procedural undertaking, but an organisational, relational, and governance-dependent practice. In crisis contexts, infection control becomes inseparable from leadership because the success of preventive measures depends on how effectively evidence, policy, workforce behaviour, and operational systems are brought into alignment. Nurse leaders occupy a central position in this process. They translate institutional and public health directives into frontline practice, coordinate multidisciplinary responses, shape safety culture, and sustain workforce confidence under conditions of uncertainty and strain. Accordingly, the conceptual basis of nurse leadership in infection control must be understood through a systems lens that integrates preparedness, decision-making, implementation capacity, and adaptive coordination (World Health Organization, 2022).

At its core, nurse leadership in infection control is grounded in the idea that leadership is exercised through influence, coordination, and accountability rather than through authority alone. In healthcare crises, leaders are not merely expected to direct activity; they must create conditions in which safe practice is possible, sustained, and responsive to changing threats. This makes nurse leadership fundamentally different from narrow managerial oversight. It involves anticipating risk, interpreting evolving guidance, mobilising staff, and maintaining continuity of safe care even when resources, staffing, and information are unstable. The World Health Organization's framework for infection prevention and control in outbreak preparedness, readiness, and response reinforces this point by presenting IPC as a facility-wide capability requiring governance structures, clearly defined responsibilities, surveillance, training, communication, and continuous improvement mechanisms (World Health Organization, 2022). Within that framework, nurse leaders are not peripheral actors; they are among the principal agents through which these structures are operationalised.

The theoretical underpinnings of this role can be interpreted through several complementary leadership perspectives. One relevant perspective is systems leadership, which views leadership as the capacity to connect multiple components of complex organisations in pursuit of collective safety and performance. Infection control during crises is inherently systemic. It depends on the interaction of staffing, environmental controls, isolation pathways, communication systems, supply chains, training, and clinical judgement. Nurse leaders function within and across these domains, making decisions that affect not only individual patient care but also wider organisational resilience. This systemic view is particularly supported by evidence showing that effective crisis leadership requires awareness that extends beyond immediate task management to encompass broader institutional interdependencies (Hopkinson & Jennings, 2021).

A second useful perspective is adaptive leadership. Healthcare crises are characterised by rapidly changing epidemiological information, evolving policy guidance, and

shifting operational constraints. In such conditions, fixed routines are often insufficient. Nurse leaders must help teams navigate ambiguity, absorb new evidence, and adjust practice without undermining confidence or coherence. Shuman and Costa (2020) capture this dynamic through their description of leadership competencies for intensive care unit nursing leaders during disasters, emergencies, and outbreaks. Their formulation of “stepping in, stepping up, and stepping out” is conceptually significant because it illustrates that leadership during crises requires simultaneous engagement at clinical, team, and strategic levels. “Stepping in” reflects direct situational involvement, “stepping up” reflects active coordination and command, and “stepping out” reflects the capacity to maintain perspective on the larger organisational picture. Together, these dimensions provide a practical expression of adaptive and multi-level leadership in crisis conditions (Shuman & Costa, 2020).

Transformational elements are also relevant to the conceptualisation of nurse leadership in infection control. Crises place extraordinary emotional and psychological demands on healthcare workers. Fear of infection, fatigue, moral strain, and uncertainty can erode adherence to protocols and weaken team function. In this environment, nurse leaders must do more than enforce standards; they must motivate, reassure, and build trust. Hopkinson and Jennings (2021) emphasise that pandemic management requires nurse leaders to demonstrate expertise that includes communication, prioritisation, resilience-building, and the ability to foster coordinated action under pressure. These features align with a transformational understanding of leadership, in which influence is exercised by articulating direction, supporting staff, and sustaining commitment to shared goals even amid disruption. Infection control, therefore, is strengthened not only by technical competence but by leadership that shapes culture and morale.

The conceptual foundations of nurse leadership in infection control are also closely linked to preparedness theory. Preparedness implies more than having protocols on paper; it refers to the extent to which individuals, teams, and organisations possess the knowledge, confidence, structures, and resources necessary to respond effectively to emergencies. Reedy *et al.* (2022) provide important evidence in this regard by demonstrating significant variation in nurse leader confidence in emergency management and disaster preparedness, with stronger confidence associated with advanced roles, higher education, and prior disaster-related training. Their findings are theoretically important because they show that leadership effectiveness in crisis settings is not simply innate or role-derived; it is shaped by education, experience, and organisational investment in leadership development. This supports a competency-based view of nurse leadership, where preparedness is a developed capability rather than an assumed attribute (Reedy *et al.*, 2022).

Competency theory further strengthens the conceptual basis of nurse leadership in infection control. Crisis leadership requires a bundle of interconnected competencies rather than isolated skills. These include situational awareness, risk communication, resource stewardship, team coordination, ethical judgement, and operational decision-making. Shuman and Costa (2020) identify such competencies in acute critical care settings, while Hopkinson and Jennings (2021) underline their importance in pandemic management across wider

systems. The theoretical implication is that infection control leadership must be viewed as practice-based and context-sensitive. Competence is not only about understanding infection prevention principles; it is about applying them within unstable, high-stakes environments where workflow disruption, staff anxiety, and competing priorities are constant. In this sense, nurse leadership in infection control is best understood as an applied capability situated within complex organisational realities.

Another foundational concept is safety culture. Infection control during crises relies heavily on whether staff perceive safety as a shared and supported organisational value. Nurse leaders contribute to this culture by modelling compliance, reinforcing standards, encouraging reporting, and creating psychologically safe environments in which staff can raise concerns. The experience of nursing homes during COVID-19, as described by Rubano, Kieffer, and Larson (2022), illustrates how infection prevention performance is shaped by structural and contextual conditions such as staffing patterns, communication, training access, and resource adequacy. Their environmental scan shows that infection control is vulnerable when systems are fragmented or under-resourced, but also that leadership can help mediate these vulnerabilities through organisation, oversight, and targeted support. The conceptual lesson is that leadership is a determinant of how institutional conditions are translated into either risk amplification or risk reduction (Rubano, Kieffer & Larson, 2022).

In more recent healthcare environments, decision-support theory also becomes relevant. Crisis leadership increasingly takes place in settings shaped by digital information flows, real-time monitoring, and data-assisted governance. Kuponiyi, Omotayo, and Akomolafe (2023) argue that artificial intelligence can enhance clinical decision-making in healthcare systems, a point that has conceptual implications for nurse leadership in infection control. While AI does not replace professional judgement, it contributes to decision-support environments that influence prioritisation, surveillance, and response coordination. During healthcare crises, nurse leaders may need to interpret data dashboards, staffing information, early warning indicators, or predictive tools alongside clinical realities. This situates infection control leadership within a broader socio-technical framework in which leadership depends not only on interpersonal competence but also on the ability to engage intelligently with information systems (Kuponiyi, Omotayo & Akomolafe, 2023).

These conceptual and theoretical foundations suggest that nurse leadership in infection control during healthcare crises is best understood as a systems-based, competency-driven, and adaptive form of practice. It is shaped by preparedness, enacted through coordination and influence, and strengthened by supportive governance, training, and information systems. The nurse leader is therefore not simply an implementer of infection control protocols, but a central architect of safe clinical response. This understanding provides the intellectual basis for examining how nurse leaders function during crises, what constrains their effectiveness, and what kinds of organisational investment are required to strengthen infection control leadership in future emergencies (World Health Organization, 2022; Reedy *et al.*, 2022; Shuman & Costa, 2020; Hopkinson & Jennings, 2021).

2.1. Healthcare Crises and the Infection Control Imperative

Healthcare crises intensify the centrality of infection prevention and control by transforming routine care environments into high-risk settings where transmission pathways are amplified, and operational stability is compromised. In such contexts, infection control is no longer a discrete clinical function but a system-wide imperative that underpins patient safety, workforce protection, and service continuity. Crises such as pandemics and large-scale outbreaks disrupt established workflows, increase patient acuity, and strain resources, thereby heightening the risk of healthcare-associated infections and necessitating rapid, coordinated responses (Lacey, Goodyear & Hanson, 2020). Nurse leaders, therefore, play a pivotal role in ensuring that infection control measures are consistently implemented despite these pressures.

The imperative for robust infection control is further reinforced by the need to adapt care delivery models in response to contagion risks. The expansion of telehealth during the COVID-19 era illustrates how healthcare systems reconfigure service pathways to reduce exposure while maintaining access to care (Omotayo & Kuponiyi, 2020). Such adaptations demonstrate that infection control extends beyond bedside practices to include system-level innovations. Effective leadership is essential in navigating these transitions, as it ensures that alternative care models remain safe, coordinated, and aligned with infection prevention principles. Consequently, infection control during healthcare crises is both a clinical necessity and a strategic leadership priority (James & Bennett, 2020).

2.2. Roles and Responsibilities of Nurse Leaders in Infection Control

Nurse leaders occupy a central and multifaceted role in advancing infection prevention and control during healthcare crises, functioning as coordinators of practice, enforcers of standards, and facilitators of organisational resilience. Their responsibilities extend beyond routine supervision to include the interpretation and operationalisation of infection control guidelines within dynamic and high-risk environments. This involves ensuring adherence to protocols such as isolation procedures, hand hygiene, and appropriate use of personal protective equipment, while simultaneously addressing workforce concerns and maintaining continuity of care (Ayoola *et al.*, 2022). In crisis settings, these responsibilities become intensified, requiring leaders to balance clinical priorities with evolving safety requirements.

Effective nurse leadership in infection control also entails real-time monitoring and decision-making, often supported by institutional data systems. The integration of predictive analytics and monitoring tools within hospital networks highlights the increasing importance of data-informed leadership in managing resources, tracking risks, and enhancing responsiveness during crises (Ajayi *et al.*, 2022). Nurse leaders must therefore engage with these systems to support timely interventions and coordinated responses.

Furthermore, crisis leadership demands adaptability, clear communication, and the ability to sustain team cohesion under pressure. Astute nurse leaders guide staff through uncertainty, reinforce accountability, and foster a culture of safety that supports consistent infection control practices (Turnipseed & VandeWaa, 2022). Collectively, these roles position nurse leaders as pivotal agents in safeguarding both

patient and workforce well-being during healthcare emergencies.

2.3. Nurse Leaders as Coordinators of Crisis Response and Safety Culture

Nurse leaders serve as pivotal coordinators of crisis response, bridging the gap between strategic directives and frontline implementation while fostering a culture of safety essential for effective infection control. Their coordinating role encompasses aligning multidisciplinary teams, streamlining communication channels, and ensuring that rapidly evolving policies are translated into coherent and actionable practices. In high-pressure environments, this requires not only operational oversight but also the capacity to synthesise information, prioritise interventions, and maintain organisational coherence. The increasing use of AI-driven business intelligence tools in public health underscores the importance of timely, data-informed coordination, enabling nurse leaders to guide decision-making and resource allocation with greater precision (Tafirenyika *et al.*, 2023).

Central to this coordinating function is the cultivation of a strong safety culture, where adherence to infection prevention measures is embedded in everyday practice. Nurse leaders influence this culture by modelling best practices, reinforcing accountability, and promoting open communication among staff. The competencies of “stepping in, stepping up, and stepping out” highlight how leaders engage at multiple levels—clinically, operationally, and strategically—to sustain safety under crisis conditions (Shuman & Costa, 2020). Furthermore, forward-looking leadership development emphasises adaptability, systems thinking, and proactive planning as essential attributes for navigating complex healthcare environments (Huston, 2008). Through these combined roles, nurse leaders ensure that crisis response remains coordinated, resilient, and firmly grounded in a culture of safety.

3. Core Leadership Functions in Infection Prevention and Control During Crises

The effectiveness of infection prevention and control during healthcare crises is fundamentally shaped by the quality and scope of leadership functions enacted within clinical and organisational systems. Nurse leaders, positioned at the interface between policy, practice, and workforce dynamics, perform a set of core functions that extend beyond administrative oversight to encompass coordination, decision-making, surveillance, communication, and cultural reinforcement. These functions are not static; rather, they evolve in response to the complexity, uncertainty, and urgency that define crisis environments. As such, understanding these leadership functions is essential to appreciating how infection control measures are operationalised and sustained under pressure.

One of the most critical leadership functions in this context is situational awareness and real-time surveillance. Effective infection control during crises depends on the continuous monitoring of risks, including transmission patterns, staff exposure, patient acuity, and resource availability. Nurse leaders play a central role in synthesising this information to inform timely interventions and adaptive responses. The integration of digital tools, such as real-time risk assessment dashboards, enhances this function by providing visibility into supply chain dynamics, resource utilisation, and emerging threats (Filani *et al.*, 2022). These tools enable

leaders to anticipate shortages, optimise the allocation of personal protective equipment, and maintain operational continuity, thereby reinforcing the responsiveness of infection control systems. However, technological capability must be complemented by leadership judgement, as data interpretation and contextual decision-making remain essential components of effective crisis management.

Closely linked to surveillance is the function of decision-making under uncertainty. Healthcare crises are characterised by rapidly evolving evidence, shifting guidelines, and competing priorities. Nurse leaders must navigate these complexities by making informed decisions that balance patient safety, staff protection, and organisational capacity. The importance of leadership knowledge and confidence in such situations has been highlighted in studies demonstrating that preparedness and experience significantly influence leaders' ability to manage disasters effectively (Carias-Sugay *et al.*, 2021). Decision-making in this context is not merely reactive; it involves anticipating potential scenarios, prioritising interventions, and ensuring that actions are aligned with both clinical evidence and organisational goals. This underscores the need for nurse leaders to possess not only technical expertise in infection control but also strategic thinking and adaptive capacity.

Another core leadership function is the coordination of multidisciplinary teams and workflows. Infection prevention and control during crises require seamless collaboration among nurses, physicians, infection prevention specialists, administrators, and support staff. Nurse leaders act as coordinators who align these diverse roles, clarify responsibilities, and ensure that care processes are coherent and efficient. The experience of past outbreaks, such as the SARS epidemic, illustrates the challenges inherent in this function, including communication breakdowns, role ambiguity, and the psychological burden placed on healthcare workers (Shih *et al.*, 2009). Effective coordination mitigates these challenges by fostering clear communication pathways, establishing structured workflows, and promoting shared accountability for infection control outcomes. In this way, nurse leaders contribute to both operational efficiency and team cohesion.

Communication itself constitutes a distinct and vital leadership function. During healthcare crises, information is often incomplete, rapidly changing, and sometimes conflicting. Nurse leaders must therefore act as reliable conduits of accurate and timely information, translating complex guidance into practical instructions that can be readily understood and implemented by frontline staff. This function is critical not only for ensuring compliance with infection control measures but also for maintaining trust and reducing anxiety among healthcare workers. Leadership models during the COVID-19 pandemic have emphasised the importance of transparent, consistent, and empathetic communication in sustaining organisational stability and workforce engagement (Nicola *et al.*, 2020; McGilton *et al.*, 2020). In the context of infection control, effective communication supports adherence to protocols, facilitates rapid problem-solving, and reinforces a shared commitment to safety.

Equally important is the function of role modelling and behavioural reinforcement. Infection prevention and control rely heavily on consistent adherence to practices such as hand hygiene, appropriate use of protective equipment, and environmental cleaning. Nurse leaders influence these

behaviours not only through instruction but also through example. By demonstrating commitment to infection control standards, leaders reinforce expectations and shape the norms that guide staff behaviour. Mollahadi, Nouri, and Moradian (2021) highlight the significance of role modelling in the COVID-19 crisis, noting that visible leadership engagement enhances credibility, motivates staff, and strengthens collective adherence to safety practices. This function is particularly important in high-stress environments where fatigue and uncertainty may otherwise undermine compliance.

Resource management and logistical oversight represent another key leadership function. Healthcare crises often strain supply chains, leading to shortages of essential materials such as personal protective equipment, disinfectants, and medical supplies. Nurse leaders must navigate these constraints by prioritising resource allocation, coordinating procurement, and ensuring that available resources are used efficiently. The application of real-time monitoring systems, as discussed by Filani *et al.* (2022), supports this function by enabling leaders to track inventory levels, anticipate demand, and respond proactively to emerging shortages. Effective resource management is critical to maintaining infection control standards, as inadequate supplies can compromise both staff safety and patient outcomes.

In addition to these operational functions, nurse leaders play a crucial role in fostering a culture of safety and resilience. Infection control during crises is not solely dependent on protocols; the attitudes, beliefs, and behaviours of healthcare workers also shape it. Leaders contribute to a positive safety culture by promoting accountability, encouraging open communication, and supporting staff wellbeing. The challenges faced by infection prevention and control units during the COVID-19 pandemic, including high workload, emotional strain, and organisational complexity, highlight the importance of leadership in sustaining morale and resilience (Chen & Cojocar, 2023). By addressing these human factors, nurse leaders enhance the capacity of teams to maintain high standards of infection control even under adverse conditions.

Finally, governance and strategic alignment constitute overarching leadership functions that integrate all other activities. Nurse leaders are responsible for ensuring that infection control practices are aligned with institutional policies, regulatory requirements, and public health directives. This involves participating in decision-making processes, contributing to policy development, and advocating for resources and support. Gould, Gallagher, and Allen (2016) emphasise that effective leadership and management are essential for advancing infection prevention and control, particularly in ensuring that organisational structures and priorities support safe practice. In crisis contexts, this function becomes even more critical, as leaders must navigate complex governance environments while maintaining focus on patient and workforce safety.

4. Preparedness, Training, and Capacity Building

Preparedness, training, and capacity building constitute foundational pillars for effective nurse leadership in infection prevention and control during healthcare crises. These elements determine not only the readiness of individual nurse leaders but also the resilience of the wider healthcare system in responding to rapidly evolving threats. Preparedness, in

this context, extends beyond the existence of protocols to encompass the development of competencies, adaptive capabilities, and organisational structures that enable timely and coordinated responses. As healthcare crises become increasingly complex, the emphasis on leadership preparedness has shifted towards continuous learning, innovation, and system-wide capacity strengthening.

Crisis leadership itself has evolved as a concept within nursing, reflecting the dynamic and unpredictable nature of modern healthcare emergencies. Kim (2021) conceptualises crisis leadership as an adaptive and evolving construct that requires flexibility, rapid decision-making, and the ability to manage uncertainty while maintaining organisational stability. This perspective highlights that preparedness is not a static achievement but an ongoing process of capability development. For nurse leaders, this implies the need for sustained engagement in training programmes that enhance situational awareness, decision-making skills, and the capacity to lead under pressure. Such preparation is critical in infection control contexts, where delays or inconsistencies in leadership response can have immediate and far-reaching consequences.

Training plays a central role in translating preparedness into practical competence. Effective training programmes for nurse leaders must integrate both technical and non-technical skills, including infection control principles, crisis communication, team coordination, and ethical decision-making. Evidence from intensive care settings during the COVID-19 pandemic indicates that nurse managers often relied on experiential learning and real-time problem-solving in the absence of fully developed training frameworks (Dobrowolska *et al.*, 2023). This underscores the importance of structured and anticipatory training approaches that prepare leaders before crises occur, rather than relying solely on reactive learning during emergencies. Training should therefore be continuous, scenario-based, and aligned with emerging risks to ensure that nurse leaders can respond effectively across diverse crises.

Capacity building, closely linked to training, involves strengthening the organisational and systemic conditions that support effective leadership. This includes ensuring adequate staffing, resource availability, infrastructure, and institutional support mechanisms. Lyng *et al.* (2021) highlight how healthcare leaders utilised innovative solutions during the COVID-19 pandemic to maintain resilience, particularly in nursing homes and community care settings. These innovations included reorganising workflows, adopting new communication strategies, and leveraging available resources to sustain infection control practices. Such findings illustrate that capacity building is not limited to resource provision but also involves fostering innovation and adaptability within healthcare systems. Nurse leaders play a crucial role in this process by identifying gaps, implementing solutions, and promoting a culture of continuous improvement.

Innovation itself emerges as a critical component of preparedness and capacity building. The relationship between nurse managers' innovation and effective crisis management has been demonstrated in recent research, which shows that innovative leadership practices enhance organisational responsiveness and problem-solving during emergencies (Mohamed, Mohammed Abu Elenin & Ibrahim, 2023). In infection control, innovation may manifest in the redesign of care pathways, the adoption of new technologies, or the development of context-specific strategies to address

emerging challenges. Nurse leaders who are equipped with innovative thinking skills are better positioned to navigate resource constraints, adapt to changing guidelines, and sustain high standards of care.

Technological competence is increasingly recognised as an essential dimension of preparedness. The integration of digital tools and data-driven systems into healthcare delivery has transformed how decisions are made and how information is managed during crises. Kuponiyi, Omotayo, and Akomolafe (2023) emphasise the role of artificial intelligence in enhancing clinical decision-making, highlighting its potential to support timely and informed responses in complex healthcare environments. For nurse leaders, this underscores the importance of digital literacy and the ability to engage with analytics, decision-support systems, and real-time data. Preparedness in contemporary healthcare crises therefore, includes not only clinical and leadership competencies but also the capacity to utilise technology effectively in guiding infection control strategies. Leadership development for crises also requires attention to experiential and reflective learning. Historical analyses of crisis leadership emphasise the value of learning from past events to inform future preparedness. George *et al.* (2010) argue that leadership during crises is shaped by prior experience, reflection, and the ability to apply lessons learned to new situations. This perspective is particularly relevant in infection control, where previous outbreaks provide valuable insights into effective practices and common pitfalls. Nurse leaders who engage in reflective practice are better able to refine their approaches, anticipate challenges, and implement evidence-based strategies in subsequent crises.

Furthermore, preparedness must address the psychological and emotional dimensions of leadership. Healthcare crises place significant strain on both leaders and frontline staff, affecting decision-making, communication, and overall performance. Training programmes that incorporate resilience-building, stress management, and emotional intelligence can enhance leaders' ability to support their teams and maintain operational effectiveness. Dobrowolska *et al.* (2023) highlight the emotional challenges experienced by nurse managers during the COVID-19 pandemic, including stress, uncertainty, and moral dilemmas. Addressing these aspects within preparedness frameworks is essential for sustaining leadership effectiveness and ensuring that infection control measures are implemented consistently. Another critical aspect of capacity building is the alignment of organisational policies and leadership structures with crisis demands. Effective preparedness requires that nurse leaders are integrated into decision-making processes and supported by clear governance frameworks. Without such alignment, even well-trained leaders may struggle to implement infection control measures effectively. Lyng *et al.* (2021) demonstrate that organisational flexibility and supportive leadership structures were key enablers of resilience during the pandemic, allowing healthcare systems to adapt rapidly to changing conditions. This highlights the importance of institutional support in enhancing leadership capacity and ensuring that preparedness efforts translate into effective action.

5. Barriers and Challenges Facing Nurse Leaders in Infection Control

Nurse leaders operating within healthcare crises encounter a complex array of barriers that significantly constrain the

effective implementation of infection prevention and control measures. These challenges are multifaceted, spanning structural, organisational, technological, and human dimensions, and are often intensified by the urgency and unpredictability that characterise crisis environments. While nurse leaders are expected to coordinate safe and efficient responses, their capacity to do so is frequently undermined by systemic limitations that hinder decision-making, disrupt workflows, and compromise adherence to infection control protocols.

One of the most persistent challenges relates to structural and infrastructural limitations within healthcare systems. Many organisations rely on legacy systems that are not designed to support rapid adaptation during crises. Fragmented digital infrastructures, inefficient workflows, and limited interoperability between systems can impede timely communication, data sharing, and coordination of care. Ezeh *et al.* (2022) highlight how legacy system barriers and workflow inefficiencies complicate healthcare operations, particularly in environments undergoing digital transformation. In the context of infection control, such limitations can delay the dissemination of updated guidelines, hinder real-time monitoring of infection risks, and reduce the overall responsiveness of healthcare teams. Nurse leaders, therefore, must often navigate outdated systems while attempting to implement dynamic and evidence-based infection control strategies.

Resource constraints represent another critical barrier. Healthcare crises frequently expose shortages in staffing, personal protective equipment, and essential medical supplies, placing additional pressure on nurse leaders responsible for maintaining safe practice. McDonald (2020) emphasises that the COVID-19 pandemic revealed significant gaps in healthcare system preparedness, including inadequate resource allocation and workforce capacity. These shortages not only compromise infection control efforts but also contribute to increased stress and fatigue among healthcare workers. Nurse leaders must balance competing demands, prioritise limited resources, and ensure that safety standards are upheld despite these constraints, a task that is both operationally and ethically challenging.

Workforce-related challenges further complicate the leadership landscape. High levels of stress, burnout, and psychological strain among nurses can negatively affect compliance with infection control measures and overall team performance. Nevala and Vuorela (2022) report that nurse managers during the COVID-19 pandemic faced considerable difficulties in managing staff wellbeing while simultaneously addressing operational demands. The dual responsibility of supporting staff and enforcing strict infection control protocols can create tension, particularly when staff members experience fear of infection, exhaustion, or moral distress. These conditions may lead to reduced morale, increased absenteeism, and variability in adherence to safety practices, all of which undermine infection control efforts.

Leadership-specific challenges also emerge in crisis contexts, particularly in relation to decision-making and communication. Rapidly changing information, evolving guidelines, and uncertainty regarding best practices can create ambiguity for nurse leaders tasked with guiding their teams. Mwape (2021) identifies the difficulty of making timely and effective decisions in the face of incomplete or conflicting information as a significant challenge during the

COVID-19 pandemic. This uncertainty can lead to inconsistencies in practice and may erode staff confidence in leadership. Furthermore, maintaining clear and consistent communication in such environments is inherently challenging, yet essential for ensuring that infection control measures are understood and implemented correctly.

The influence of leadership style and crisis management skills also presents a critical challenge. Effective infection control requires leadership approaches that foster trust, collaboration, and accountability. However, variations in leadership style and competency can impact the safety climate within healthcare organisations. Jankelová, Moricová, and Slezáková (2023) demonstrate that leadership style and crisis management capabilities significantly influence the working climate and safety perceptions of nurses during the pandemic. Inadequate leadership skills or inappropriate leadership approaches may contribute to confusion, reduced compliance with protocols, and diminished team cohesion. This highlights the importance of leadership development and the need for nurse leaders to possess both technical and interpersonal competencies.

Organisational complexity and bureaucratic constraints further exacerbate these challenges. Healthcare institutions often operate within hierarchical structures that may limit the autonomy of nurse leaders and delay decision-making processes. During crises, the need for rapid action may conflict with established procedures and approval mechanisms, creating tension between responsiveness and governance. Nurse leaders may find themselves navigating competing priorities, balancing organisational directives with frontline realities, and advocating for necessary resources and changes within constrained systems.

Additionally, the dynamic nature of healthcare crises introduces challenges related to adaptability and resilience. The constant evolution of the situation requires nurse leaders to continuously reassess strategies, update protocols, and manage shifting priorities. This ongoing demand for adaptability can be physically and mentally taxing, particularly in prolonged crises. Nevala and Vuorela (2022) highlight how the sustained intensity of crisis conditions can lead to cumulative fatigue among nurse leaders, affecting their ability to maintain high levels of performance over time. Technological challenges also play a significant role in shaping the effectiveness of infection control leadership. While digital tools have the potential to enhance coordination and decision-making, their implementation is often hindered by issues such as inadequate training, resistance to change, and system incompatibilities. Ezeh *et al.* (2022) note that overcoming legacy system barriers requires not only technological investment but also organisational commitment to change management. Without adequate support, nurse leaders may struggle to integrate new technologies into existing workflows, limiting their potential to improve infection control outcomes.

Finally, ethical challenges are inherent in crisis leadership. Nurse leaders must make difficult decisions regarding resource allocation, staff deployment, and patient care priorities, often under conditions of scarcity and uncertainty. These decisions can carry significant moral implications and may contribute to moral distress among leaders and staff alike. McDonald (2020) underscores the ethical complexity of pandemic response, highlighting the need for leadership that is both principled and pragmatic.

6. Enablers and Strategies for Effective Nurse-Led Infection Control

Effective nurse-led infection prevention and control during healthcare crises is contingent upon a combination of enabling conditions and strategic leadership practices that support coordination, adaptability, and sustained adherence to safety standards. While challenges are inherent in crisis environments, evidence suggests that strong leadership frameworks, system-level alignment, and process optimisation can significantly enhance the effectiveness of infection control efforts. Nurse leaders, therefore, must not only respond to immediate threats but also actively cultivate the organisational conditions that enable consistent and resilient practice.

One of the primary enablers of effective nurse-led infection control is the presence of clear leadership frameworks that emphasise communication, visibility, and ethical accountability. Rosa, Schlak, and Rushton (2020) propose a leadership blueprint during crises that highlights the importance of transparent communication, moral courage, and relational leadership. These elements are critical in fostering trust among healthcare teams, particularly when uncertainty and fear are prevalent. Nurse leaders who maintain open lines of communication and demonstrate ethical clarity are better positioned to guide staff adherence to infection control measures and to sustain morale under pressure. This relational approach strengthens team cohesion and reinforces a shared commitment to safety.

Closely related to leadership frameworks is the importance of role clarity and coordinated team functioning. Infection control during crises requires seamless collaboration across disciplines and care settings. Choi, Jeffers, and Logsdon (2020) emphasise that nurses play a central role in managing risks and responsibilities during global outbreaks, underscoring the need for clearly defined roles and responsibilities within healthcare teams. Nurse leaders facilitate this coordination by aligning tasks, ensuring accountability, and minimising duplication or gaps in care processes. Effective coordination not only improves workflow efficiency but also enhances the consistency with which infection control protocols are implemented.

System redesign and process optimisation represent another critical strategy for strengthening nurse-led infection control. The complexity of healthcare crises often exposes inefficiencies in existing workflows, necessitating rapid adaptation and innovation. Gado *et al.* (2022) highlight the value of streamlining patient journey mapping as a systems-based approach to improving care continuity and treatment persistence. In the context of infection control, such approaches enable nurse leaders to redesign care pathways in ways that minimise transmission risks, reduce unnecessary contact, and optimise patient flow. By reconfiguring processes to align with infection prevention principles, nurse leaders can enhance both safety and operational efficiency.

Adaptability and responsiveness are also key enablers of effective leadership in crisis contexts. Nurse leaders must be capable of adjusting strategies in response to evolving conditions, including changes in infection patterns, resource availability, and policy directives. Wymer, Stucky, and De Jong (2021) argue that nursing leadership during COVID-19 required the ability to lead “ahead of the data,” making informed decisions even when evidence was incomplete. This highlights the importance of proactive and forward-thinking leadership, where nurse leaders anticipate

challenges and implement preventive measures before issues escalate. Such adaptability is essential for maintaining control over rapidly changing situations and ensuring that infection control measures remain effective.

Another important enabler is experiential learning and knowledge sharing. Early experiences from healthcare settings during the COVID-19 pandemic demonstrate that nurse leaders who engaged in continuous learning and reflection were better able to refine their approaches and improve outcomes. Nevala (2021) notes that nurse managers in primary healthcare settings developed practical strategies through real-time problem-solving and collaboration. This iterative learning process allows leaders to identify best practices, address emerging challenges, and disseminate knowledge across teams. By fostering a culture of learning, nurse leaders enhance organisational resilience and strengthen the overall capacity for infection control.

Supportive organisational structures also play a crucial role in enabling effective nurse-led infection control. Leadership effectiveness is significantly enhanced, and nurse leaders are integrated into decision-making processes and supported by clear governance frameworks. Access to resources, administrative support, and institutional backing allows nurse leaders to implement strategies more effectively and to advocate for necessary changes. Without such support, even the most capable leaders may struggle to translate plans into action. Therefore, organisational commitment to empowering nurse leadership is a critical factor in successful infection control during crises.

In addition, attention to staff wellbeing and psychological support is an essential strategy for sustaining infection control efforts. Healthcare crises place considerable emotional and physical demands on nurses, which can affect performance and adherence to protocols. Nurse leaders who prioritise staff wellbeing—through supportive communication, workload management, and access to mental health resources—create an environment in which staff are more likely to remain engaged and compliant with infection control measures. This human-centred approach not only enhances individual performance but also contributes to a more resilient and cohesive workforce.

Finally, the integration of coordinated communication and feedback mechanisms strengthens the effectiveness of infection control strategies. Continuous feedback allows nurse leaders to monitor compliance, identify gaps, and implement corrective actions promptly. It also provides an opportunity for staff to voice concerns and contribute to problem-solving, thereby enhancing engagement and ownership of infection control practices.

7. Technology, Innovation, and Digital Support for Nurse Leadership

Technology and innovation have become indispensable components of nurse leadership in infection prevention and control, particularly during healthcare crises characterised by uncertainty, rapid transmission risks, and system-wide disruption. Digital tools and data-driven systems not only enhance operational efficiency but also strengthen the capacity of nurse leaders to make informed decisions, coordinate responses, and maintain continuity of care. As healthcare systems increasingly adopt technological solutions, nurse leadership is evolving to incorporate digital competence as a critical dimension of effective crisis management.

One of the most significant contributions of technology to nurse-led infection control lies in real-time monitoring and risk assessment. The use of machine learning-driven dashboards enables healthcare organisations to track supply chain dynamics, resource utilisation, and emerging risks with greater accuracy and speed. Filani *et al.* (2022) demonstrate how real-time risk assessment dashboards enhance visibility across hospital systems, allowing leaders to anticipate shortages, optimise the distribution of personal protective equipment, and maintain operational continuity. For nurse leaders, such tools provide actionable insights that support proactive decision-making and reduce delays in response, thereby strengthening infection control outcomes.

In addition to monitoring systems, artificial intelligence has emerged as a transformative force in clinical decision-making. AI-driven tools support the analysis of complex datasets, enabling more precise identification of trends, risks, and intervention priorities. Kuponiyi, Omotayo, and Akomolafe (2023) highlight the role of AI in improving clinical decision-making within healthcare systems, emphasising its potential to enhance accuracy and efficiency. In the context of infection control, these capabilities allow nurse leaders to interpret data more effectively, guide evidence-based interventions, and coordinate responses across multidisciplinary teams. The integration of AI into healthcare leadership frameworks thus represents a shift towards more data-informed and predictive approaches to crisis management.

Telehealth represents another critical innovation that has reshaped healthcare delivery during crises. The expansion of remote care models has enabled healthcare systems to reduce physical contact, minimise transmission risks, and maintain access to essential services. Omotayo and Kuponiyi (2020) illustrate how telehealth emerged as a key strategy in post-COVID healthcare systems, facilitating continuity of care while addressing infection control concerns. For nurse leaders, the adoption of telehealth requires not only technical understanding but also the ability to redesign care pathways, coordinate virtual teams, and ensure that remote services meet safety and quality standards. This shift highlights the growing intersection between clinical leadership and digital service delivery.

Beyond specific technologies, innovation more broadly plays a crucial role in enhancing nurse leadership during healthcare crises. Innovation in this context involves the development and implementation of new approaches to care delivery, communication, and resource management. Asgari, Panahi, and Pouy (2021) emphasise the expanding scope of nursing leadership in health disasters, noting that innovation is essential for addressing complex and evolving challenges. Nurse leaders who embrace innovative thinking are better equipped to adapt to changing conditions, implement context-specific solutions, and sustain infection control practices under pressure.

The integration of digital tools also supports improved communication and coordination, which are critical for effective infection control. During crises, timely and accurate information sharing is essential for aligning teams and ensuring consistent practice. Experiences from the early phase of the COVID-19 pandemic highlight how structured communication systems contributed to moving healthcare environments from initial chaos to greater control (Rücker *et al.*, 2021). Digital platforms facilitate the rapid dissemination of guidelines, enable real-time feedback, and support

collaborative decision-making, thereby enhancing the overall effectiveness of nurse-led interventions.

However, the adoption of technology is not without challenges. Nurse leaders must navigate issues related to digital literacy, system integration, and the potential for information overload. Dahl (2021) notes that leadership in crisis contexts often involves managing both technological and human complexities, requiring leaders to balance data-driven insights with experiential knowledge. This underscores the importance of training and capacity building to ensure that nurse leaders can effectively utilise digital tools without compromising the human aspects of care.

Furthermore, the human dimension of healthcare remains central, even as technology becomes more prominent. The COVID-19 pandemic highlighted the critical role of the nursing workforce and the need to address issues such as moral distress, mental health, and professional recognition. Studies have shown that healthcare crises can exacerbate psychological strain among nurses, affecting their ability to engage fully with both clinical and technological demands (Lake *et al.*, 2022; Jun, Melnyk & Tucker, 2020). Nurse leaders must therefore ensure that technological innovation is implemented in a way that supports, rather than burdens, the workforce.

Ethical considerations also arise in the use of digital technologies. The increasing reliance on data-driven systems raises questions about privacy, equity, and access, particularly in resource-limited settings. Buheji and Buhaid (2020) highlight the importance of considering human factors in nursing during the COVID-19 pandemic, emphasising that technological solutions must be aligned with ethical and professional values. Nurse leaders play a key role in ensuring that digital innovations are implemented responsibly and that they contribute to equitable and patient-centred care.

Finally, the integration of technology into nurse leadership must be understood within the broader context of healthcare transformation. The challenges faced by nurse managers during the pandemic underscore the need for leadership approaches that are flexible, technologically informed, and responsive to changing demands (Ahlqvist, Nurmeksela & Kvist, 2023). As healthcare systems continue to evolve, the ability of nurse leaders to harness technology and innovation will be critical in shaping effective infection control strategies and improving overall system resilience.

8. Outcomes and Impact of Nurse Leadership in Infection Control

The outcomes and impact of nurse leadership in infection prevention and control during healthcare crises are multidimensional, encompassing clinical effectiveness, organisational resilience, workforce wellbeing, and system sustainability. Effective nurse leadership not only enhances adherence to infection control measures but also strengthens institutional responsiveness and continuity of care under conditions of uncertainty. These outcomes are particularly evident in crisis contexts, where leadership capacity directly influences both immediate and long-term healthcare performance.

At the clinical level, strong nurse leadership contributes to improved infection control compliance and reduced transmission risks within healthcare settings. Nurse leaders play a critical role in ensuring that protocols are consistently implemented, monitored, and adapted to evolving conditions. The World Health Organization (2022) emphasises that

effective infection prevention and control systems rely on leadership that can integrate policy, practice, and workforce engagement. When nurse leaders are actively involved in coordinating these elements, healthcare facilities are better equipped to contain outbreaks and protect both patients and staff. This is further supported by qualitative evidence demonstrating that nurse leaders' ability to manage crises directly affects the effectiveness of infection control interventions (Wang *et al.*, 2021).

Organisational outcomes are also significantly shaped by nurse leadership. The use of monitoring systems and predictive analytics enhances institutional responsiveness, enabling healthcare organisations to anticipate risks, allocate resources efficiently, and maintain operational continuity. Ajayi *et al.* (2022) highlight how real-time monitoring systems improve organisational efficiency and decision-making, which are critical for sustaining infection control during crises. Nurse leaders who effectively utilise such systems can enhance coordination, reduce delays, and ensure that resources such as personal protective equipment are distributed appropriately. These capabilities contribute to improved organisational performance and resilience in the face of ongoing challenges.

Workforce-related outcomes represent another important dimension of nurse leadership impact. Healthcare crises often place significant psychological and emotional strain on nurses, affecting their ability to perform effectively. Leadership approaches that prioritise empathy, communication, and support have been shown to mitigate anxiety and enhance staff wellbeing. Hofmeyer and Taylor (2021) emphasise that empathetic leadership enables nurse leaders to address sources of distress and maintain workforce stability. Similarly, inclusive leadership practices can reduce psychological distress and foster a supportive work environment, thereby enhancing staff engagement and adherence to infection control measures (Ahmed, Zhao, & Faraz, 2020). These outcomes are critical, as a stable and motivated workforce is essential for sustaining high standards of care during crises.

The relational and cultural influence of nurse leadership is equally profound, particularly in shaping organisational resilience and sustaining a strong safety culture during healthcare crises. Leadership approaches that prioritise trust, collaboration, and shared accountability are instrumental in fostering environments where adherence to infection control practices becomes embedded in everyday clinical behaviour. Such environments enable teams to function cohesively under pressure and maintain high standards of care despite uncertainty. It has been argued that leadership plays a pivotal role in activating organisational resilience, especially in crisis contexts, by aligning team dynamics with adaptive and responsive practices (Teo, Lee & Lim, 2017).

This perspective is further reinforced by evidence from large-scale emergency responses, where structured nursing leadership has been critical in coordinating care delivery across complex and rapidly changing environments. For instance, the deployment of United States Public Health Service nurses during global crises illustrates how leadership grounded in preparedness, collaboration, and operational discipline can enhance system-wide responsiveness and resilience (Brown-Stephenson, 2017). Through such coordinated efforts, nurse leaders not only support effective crisis response but also strengthen institutional capacity to absorb shocks, adapt to evolving demands, and recover from

disruptions. Consequently, the relational and cultural dimensions of nurse leadership remain central to sustaining resilient healthcare systems and ensuring the continuity of safe and effective infection control practices. This cultural dimension is further reinforced by evidence showing that nursing staff perceive leadership-driven solutions as instrumental in navigating crises and improving outcomes (de Freitas *et al.*, 2022).

In addition to immediate outcomes, nurse leadership has long-term implications for system sustainability and quality improvement. Effective leadership during crises often leads to the development of new practices, innovations, and organisational learning that can be sustained beyond the emergency period. Dawson, Burgess, and Latuszynska (2023) highlight the role of quality improvement initiatives in maintaining healthcare performance during crises, suggesting that leadership-driven innovations can contribute to lasting improvements in care delivery. Nurse leaders, by identifying gaps and implementing solutions, play a key role in embedding these improvements within healthcare systems. The impact of nurse leadership is also evident in broader public health and disaster response contexts. Nurses have been recognised as essential leaders in disaster preparedness and response, contributing to coordinated efforts that extend beyond individual healthcare facilities (Veenema *et al.*, 2016). Their involvement in crisis management enhances the overall effectiveness of health systems in responding to emergencies. Similarly, expanded leadership roles, such as those undertaken by clinical nurse specialists during the COVID-19 pandemic, demonstrate the adaptability and influence of nursing leadership in addressing complex challenges (Ladak, Lee & Sasinski, 2021). These examples underscore the important impact of nurse leadership on both local and global health outcomes.

Furthermore, leadership style plays a crucial role in shaping crisis management outcomes. Caring and supportive leadership approaches have been associated with improved crisis management effectiveness and enhanced staff perceptions of organisational support (Ali, Elsharawy & Abdelmonem, 2023). Such approaches not only improve immediate responses but also contribute to long-term organisational trust and cohesion.

9. Future Directions for Research, Policy, and Practice

The evolving complexity of healthcare crises necessitates a forward-looking agenda that strengthens nurse leadership in infection prevention and control through targeted research, progressive policy development, and transformative practice innovations. As recent global health emergencies have demonstrated, future preparedness must move beyond reactive responses towards proactive, system-wide resilience that integrates leadership, technology, workforce capacity, and organisational adaptability.

From a research perspective, there is a pressing need to generate robust empirical evidence linking specific nurse leadership approaches to infection control outcomes. While existing studies highlight the importance of leadership in crisis contexts, further investigation is required to identify which leadership models most effectively enhance compliance, reduce transmission, and support workforce wellbeing. Additionally, future research should explore the integration of digital technologies into leadership practice, particularly in relation to data-driven decision-making and real-time surveillance. The development of AI-driven

business intelligence systems offers significant potential for improving strategic responsiveness in public health and healthcare organisations, yet their application within nurse leadership remains underexplored (Tafirenyika *et al.*, 2023; Kitson *et al.*, 2023). Research that examines how nurse leaders engage with such technologies, and how these tools influence decision-making and outcomes, will be critical in advancing evidence-based leadership practices.

Policy development must also prioritise the institutionalisation of nurse leadership within infection control and crisis management frameworks. This includes ensuring that nurse leaders are actively involved in strategic planning, governance structures, and policy formulation at both organisational and national levels. Workforce policies should address staffing adequacy, as evidence consistently demonstrates the relationship between nurse staffing levels and infection outcomes (Jackson *et al.*, 2002). Strengthening staffing frameworks is essential not only for routine care but also for surge capacity during crises. Furthermore, policies should support leadership development through structured training programmes, mentorship, and continuous professional development, thereby enhancing preparedness across healthcare systems.

The integration of digital health solutions represents another critical policy and practice direction. The expansion of telehealth during and after the COVID-19 pandemic has demonstrated its value in reducing exposure risks and maintaining continuity of care (Omotayo & Kuponiyi, 2020; Kameg, 2020). Future policies should therefore support the sustained adoption of telehealth and other digital innovations, ensuring that these technologies are accessible, equitable, and aligned with infection-control objectives. Nurse leaders will play a key role in operationalising these technologies, necessitating investment in digital literacy and infrastructure to support effective implementation.

In practice, the future of nurse leadership in infection control will depend on the ability to foster resilient and adaptive healthcare environments. This includes promoting inclusive leadership approaches that prioritise psychological safety, staff engagement, and collaborative decision-making. Inclusive leadership has been shown to enhance employee well-being and reduce psychological distress during crises, thereby supporting sustained performance and adherence to safety protocols (Ahmed *et al.*, 2021). Embedding such leadership practices within organisational cultures will be essential for maintaining workforce stability and effectiveness in future emergencies.

Innovation and organisational learning must also be central to future practice. Experiences from recent crises highlight the importance of learning from past events and translating these lessons into improved systems and processes. Ward-Miller *et al.* (2021) emphasise the role of resilience and innovation in shaping effective responses to healthcare challenges, suggesting that continuous learning and adaptability are key to long-term success. Nurse leaders, as agents of change, are well-positioned to drive these innovations and to ensure that improvements are sustained beyond the immediate crisis.

10. Conclusion

The present review set out to examine the role of nurse leadership in infection prevention and control during healthcare crises, with particular attention to leadership functions, contextual challenges, enabling strategies, and

future directions for strengthening practice. The objectives of identifying core leadership roles, analysing barriers and enablers, and exploring implications for policy, research, and practice have been systematically addressed through a synthesis of contemporary evidence and interdisciplinary perspectives.

The findings demonstrate that nurse leadership is central to the effectiveness of infection control in crisis settings. Nurse leaders' function as coordinators of care, interpreters of policy, and facilitators of safety culture, ensuring that infection prevention measures are translated into consistent and context-sensitive practice. Their contributions extend across surveillance, decision-making, communication, resource management, and workforce support, highlighting the multidimensional nature of leadership in complex and rapidly evolving environments. Importantly, the review underscores that effective infection control is not solely dependent on technical protocols but is deeply influenced by leadership capacity, organisational alignment, and workforce engagement.

At the same time, the study reveals persistent challenges that constrain nurse-led infection control, including resource limitations, workforce strain, fragmented systems, and variability in leadership preparedness. These barriers emphasise the need for systemic improvements that support nurse leaders in fulfilling their roles effectively. Conversely, enabling factors such as strong governance, continuous training, technological integration, and a culture of collaboration and resilience were identified as critical to enhancing leadership effectiveness and sustaining high standards of care.

In light of these findings, the study concludes that strengthening nurse leadership must be prioritised as a strategic component of healthcare crisis preparedness. Recommendations include investing in leadership development programmes, improving staffing and resource allocation, integrating digital and data-driven tools into leadership practice, and embedding nurse leaders within decision-making structures. Furthermore, future research should focus on establishing clearer links between leadership practices and infection control outcomes, thereby advancing evidence-based approaches. Collectively, these measures will contribute to more resilient healthcare systems capable of responding effectively to future crises. Top of Form

References

1. Ahlqvist A, Nurmeksela A, Kvist T. The COVID-19 pandemic challenged nurse managers' daily leadership work: a qualitative study. *J Nurs Manag.* 2023;2023(1):8191426. doi:10.1155/2023/8191426
2. Ahmed F, Zhao F, Faraz NA. How and when does inclusive leadership curb psychological distress during a crisis? Evidence from the COVID-19 outbreak. *Front Psychol.* 2020;11:1898. doi:10.3389/fpsyg.2020.01898
3. Ahmed F, Zhao F, Faraz NA, Qin YJ. How inclusive leadership paves the way for psychological well-being of employees during trauma and crisis: a three-wave longitudinal mediation study. *J Adv Nurs.* 2021;77(2):819-831. doi:10.1111/jan.14637
4. Ajayi AE, Moyo TM, Tafirenyika S, Taiwo AE, Tuboalabo A, Bukhari TT. Predictive analytics systems for enhancing financial forecast accuracy and real-time monitoring in hospital networks. *Int J Multidiscip Evol Res.* 2022;3(2):24-34. doi:10.54660/IJMER.2022.3.2.24

5. Ali FR, Elsharawy AM, Abdelmonem AM. The relation between caring leadership and crisis management during Covid 19 as perceived by nursing staff. *Benha J Appl Sci.* 2023;8(4):105-113. Available from: https://bjas.journals.ekb.eg/article_287609_ba077292992f7dadcfb73c44c552f2d4.pdf
6. Asgari F, Panahi L, Pouy S. COVID-19: What should we do in future crises? The leadership role and scope of nurses in a health disaster: a scoping review. *Eurasian J Emerg Med.* 2021;20(2):211-218.
7. Ayoola AA, Adeoye OF, Ayoola A, Joy A. Evaluating the evolving role of nurses in healthcare infection control amid COVID-19. *Int J Med Biomed Health Res.* 2022;3(4):122-130. doi:10.54660/IJMBHR.2022.3.4.122-130
8. Brown-Stephenson M. United States Public Health Service nurses: deployment in global crisis. *Online J Issues Nurs.* 2017;22(1):1G.
9. Buheji M, Buhaid N. Nursing human factors during the COVID-19 pandemic. *Int J Nurs Sci.* 2020;10(1):12-24.
10. Carioso-Sugay J, Hultgren M, Browder BA, Chen JL. Nurse leaders' knowledge and confidence in managing disasters in the acute care setting. *Nurs Adm Q.* 2021;45(2):142-151. doi:10.1097/NAQ.0000000000000468
11. Chen D, Cojocar S. Navigating a pandemic: leadership dynamics and challenges within infection prevention and control units in Israel. *Healthcare (Basel).* 2023;11(22):2966. doi:10.3390/healthcare11222966
12. Choi KR, Jeffers KS, Logsdon MC. Nursing and the novel coronavirus: risks and responsibilities in a global outbreak. *J Adv Nurs.* 2020;76(7):1486. doi:10.1111/jan.14369
13. Dahl J. Nursing leadership in crisis: an autoethnographic study [dissertation]. La Verne (CA): University of La Verne; 2021.
14. Dawson A, Burgess N, Latuszynska A. The role of quality improvement in sustaining healthcare during crisis. In: *Shaping high quality, affordable and equitable healthcare: meaningful innovation and system transformation.* Cham: Springer International Publishing; 2023. p. 233-250. doi:10.1007/978-3-031-24212-0_11
15. de Freitas JS, Savieto RM, Melo ALQ, Bortotti IM, Laselva CR, Leão ER. Nurses' perception of solutions proposed by nurse leaders in the face of the COVID-19 pandemic: a cross-sectional study. *J Nurs Manag.* 2022;30(8):4145-4155. doi:10.1111/jonm.13896
16. Dobrowolska B, Gutysz-Wojnicka A, Dziurka M, Ozdoba P, Ozga D, Penar-Zadarko B, *et al.* Intensive care nurse managers' experiences during the first wave of the COVID-19 pandemic: implications for future epidemiological crises. *PLoS One.* 2023;18(8):e0290722. doi:10.1371/journal.pone.0290722
17. Ezech FE, Anthony P, Adeleke AS, Gbaraba SV, Gado P, Moyo TM, *et al.* Digitizing healthcare enrollment workflows: overcoming legacy system barriers in specialty care. *Int J Multidiscip Futur Dev.* 2022;3(2):19-37.
18. Filani OM, Nnabueze SB, Ike PN, Wedraogo L. Real-time risk assessment dashboards using machine learning in hospital supply chain management systems. *Int J Multidiscip Evol Res.* 2022;3(1):65-76. doi:10.54660/IJMER.2022.3.1.65-76
19. Gado P, Gbaraba SV, Adeleke AS, Anthony P, Ezech FE, Moyo TM, *et al.* Streamlining patient journey mapping: a systems approach to improving treatment persistence. *Int J Multidiscip Futur Dev.* 2022;3(2):38-57.
20. George WW, Denham CR, Burgess LH, Angood PB, Keohane C. Leading in crisis: lessons for safety leaders. *J Patient Saf.* 2010;6(1):24-30. doi:10.1097/PTS.0b013e3181d2a919
21. Gould DJ, Gallagher R, Allen D. Leadership and management for infection prevention and control: what do we have and what do we need? *J Hosp Infect.* 2016;94(2):165-168. doi:10.1016/j.jhin.2016.07.005
22. Guilamo-Ramos V, Thimm-Kaiser M, Benzekri A, Hidalgo A, Lanier Y, Tlou S, *et al.* Nurses at the frontline of public health emergency preparedness and response: lessons learned from the HIV/AIDS pandemic and emerging infectious disease outbreaks. *Lancet Infect Dis.* 2021;21(10):e326-e333. doi:10.1016/S1473-3099(20)30983-X
23. Hofmeyer A, Taylor R. Strategies and resources for nurse leaders to use to lead with empathy and prudence so they understand and address sources of anxiety among nurses practising in the era of COVID-19. *J Clin Nurs.* 2021;30(1-2):298-305. doi:10.1111/jocn.15520
24. Hopkinson SG, Jennings BM. Nurse leader expertise for pandemic management: highlighting the essentials. *Mil Med.* 2021;186(Suppl 2):9-14. doi:10.1093/milmed/usab003
25. Huston C. Preparing nurse leaders for 2020. *J Nurs Manag.* 2008;16(8):905-911. doi:10.1111/j.1365-2834.2008.00942.x
26. Jackson M, Chiarello LA, Gaynes RP, Gerberding JL. Nurse staffing and health care-associated infections: proceedings from a working group meeting. *Am J Infect Control.* 2002;30(4):199-206. doi:10.1067/mic.2002.123416
27. James AH, Bennett CL. Effective nurse leadership in times of crisis. *Nurs Manag (Harrow).* 2020;27(4). doi:10.7748/nm.2020.e1936
28. Jun J, Melnyk BM, Tucker S. Clinician mental health and well-being during global healthcare crises: evidence learned from prior epidemics for the COVID-19 pandemic. 2020. Available from: <https://stacks.cdc.gov/view/cdc/248800>
29. Kameg BN. Psychiatric-mental health nursing leadership during coronavirus disease 2019 (COVID-19). *J Psychiatr Ment Health Nurs.* 2021;28(4):507. doi:10.1111/jpm.12662
30. Kim SJ. Crisis leadership: an evolutionary concept analysis. *Appl Nurs Res.* 2021;60:151454. doi:10.1016/j.apnr.2021.151454
31. Kitson AL, Conroy T, Jeffs L, Carr D, Huisman-Dewaal GJ, Muntlin A, *et al.* 'No more heroes': the ILC Oxford Statement on fundamental care in times of crises. *J Adv Nurs.* 2023;79(3):922-932. doi:10.1111/jan.15533
32. Kuponiyi A, Omotayo O, Akomolafe OO. Leveraging AI to improve clinical decision-making in healthcare systems. *J Futur Med Res.* 2023;4(2):223-242. doi:10.54660/JFMR.2023.4.2.223-242
33. Lacey SR, Goodyear C, Hanson MD. An enduring crisis: nurse leaders' perspectives. *Nurs Econ.* 2020;38(5):258-266.
34. Ladak A, Lee B, Sasinski J. Clinical nurse specialist

- expands to crisis management role during the COVID-19 pandemic. *Clin Nurse Spec.* 2021;35(6):291-299. doi:10.1097/NUR.0000000000000632
35. Lake ET, Narva AM, Holland S, Smith JG, Cramer E, Rosenbaum KEF, *et al.* Hospital nurses' moral distress and mental health during COVID-19. *J Adv Nurs.* 2022;78(3):799-809. doi:10.1111/jan.15013
 36. Lam SK, Kwong EW, Hung MS, Pang SM, Chiang VC. Nurses' preparedness for infectious disease outbreaks: a literature review and narrative synthesis of qualitative evidence. *J Clin Nurs.* 2018;27(7-8):e1244-e1255. doi:10.1111/jocn.14210
 37. Loveday H, Wilson J. Pandemic preparedness and the role of infection prevention and control – how do we learn? *J Infect Prev.* 2021;22(2):55-57. doi:10.1177/17571774211001040
 38. Lyng HB, Ree E, Wibe T, Wiig S. Healthcare leaders' use of innovative solutions to ensure resilience in healthcare during the Covid-19 pandemic: a qualitative study in Norwegian nursing homes and home care services. *BMC Health Serv Res.* 2021;21(1):878. doi:10.1186/s12913-021-06923-1
 39. McDonald T. Getting the COVID-19 pandemic into perspective: a nursing imperative. *Int Nurs Rev.* 2020;67(3):305-317. doi:10.1111/inr.12608
 40. McGilton KS, Escrig-Pinol A, Gordon A, Chu CH, Zúñiga F, Sanchez MG, *et al.* Uncovering the devaluation of nursing home staff during COVID-19: are we fuelling the next health care crisis? *J Am Med Dir Assoc.* 2020;21(7):962-965. doi:10.1016/j.jamda.2020.06.010
 41. Mohamed HA, Mohammed Abu Elenin KA, Ibrahim SAA. Relationship between nurse managers' innovation and crisis management at healthcare organizations. *Port Said Sci J Nurs.* 2023;10(4):23-48. doi:10.21608/pssjn.2023.218221.1269
 42. Mollahadi M, Nouri JM, Moradian ST. Role model nursing leaders in the COVID-19 crisis. *BMJ Leader.* 2021. doi:10.1136/leader-2021-000473
 43. Mwape L. Nursing leadership challenges and opportunities during COVID-19 (SARS-CoV-2) pandemic response in Zambia. *Int J Res Nurs.* 2021.
 44. Nevala MS, Vuorela S. Early nurse management experiences from Finnish COVID-19 hubs: an in-action review. *Int J Environ Res Public Health.* 2022;19(8):4885. doi:10.3390/ijerph19084885
 45. Nicola M, Sohrabi C, Mathew G, Kerwan A, Al-Jabir A, Griffin M, *et al.* Health policy and leadership models during the COVID-19 pandemic: a review. *Int J Surg.* 2020;81:122-129. doi:10.1016/j.ijsu.2020.07.026
 46. Omotayo OO, Kuponiyi AB. Telehealth expansion in post-COVID healthcare systems: challenges and opportunities. *ICONIC Res Eng J.* 2020;3(10):496-513.
 47. Reedy JC, Zedreck JF, Ren D, Warburton CM, Fennimore L. Nurse leader preparation for disasters: a cross-sectional survey. *J Nurs Adm.* 2022;52(10):536-541. doi:10.1097/NNA.0000000000001203
 48. Rosa WE, Schlak AE, Rushton CH. A blueprint for leadership during COVID-19. *Nurs Manage.* 2020;51(8):28-34. doi:10.1097/01.NUMA.0000688940.29231.6f
 49. Rubano MD, Kieffer EF, Larson EL. Infection prevention and control in nursing homes during COVID-19: an environmental scan. *Geriatr Nurs.* 2022;43:51-57. doi:10.1016/j.gerinurse.2021.11.001
 50. Rucker F, Hårdstedt M, Rucker SCM, Aspelin E, Smirnoff A, Lindblom A, *et al.* From chaos to control – experiences of healthcare workers during the early phase of the COVID-19 pandemic: a focus group study. *BMC Health Serv Res.* 2021;21(1):1219. doi:10.1186/s12913-021-07248-9
 51. Shih FJ, Turale S, Lin YS, Gau ML, Kao CC, Yang CY, *et al.* Surviving a life-threatening crisis: Taiwan's nurse leaders' reflections and difficulties fighting the SARS epidemic. *J Clin Nurs.* 2009;18(24):3391-3400. doi:10.1111/j.1365-2702.2008.02521.x
 52. Shuman CJ, Costa DK. Stepping in, stepping up, and stepping out: competencies for intensive care unit nursing leaders during disasters, emergencies, and outbreaks. *Am J Crit Care.* 2020;29(5):403-406. doi:10.4037/ajcc2020421
 53. Tafirenyika S, Moyo TM, Tuboalabo A, Taiwo AE, Bukhari TT, Ajayi AE, *et al.* Developing AI-driven business intelligence tools for enhancing strategic decision-making in public health agencies. *Int J Multidiscip Futur Dev.* 2023;4(1). doi:10.54660/IJMF.2023.4.1.58
 54. Teo WL, Lee M, Lim WS. The relational activation of resilience model: how leadership activates resilience in an organizational crisis. *J Contingencies Crisis Manag.* 2017;25(3):136-147. doi:10.1111/1468-5973.12179
 55. Veenema TG, Griffin A, Gable AR, MacIntyre L, Simons RN, Couig MP, *et al.* Nurses as leaders in disaster preparedness and response—a call to action. *J Nurs Scholarsh.* 2016;48(2):187-200. doi:10.1111/jnu.12198
 56. Wang J, Tang L, Da H, Lu H, Shi X, Li L. Nurse leaders' reflections and difficulties fighting the NCP epidemic: a qualitative study. *Res Sq.* 2021. doi:10.21203/rs.3.rs-197693/v1
 57. Ward-Miller S, Farley EM, Espinosa L, Brous ME, Giorgi-Cipriano J, Ferguson J. Psychiatric mental health nursing in the international year of the nurse and COVID-19: one hospital's perspective on resilience and innovation—past, present, and future. *Arch Psychiatr Nurs.* 2021;35(3):303-310. doi:10.1016/j.apnu.2020.11.002
 58. World Health Organization. Framework and toolkit for infection prevention and control in outbreak preparedness, readiness, and response at the health care facility level. Geneva: World Health Organization; 2022.
 59. Wymer JA, Stucky CH, De Jong MJ. Nursing leadership and COVID-19: defining the shadows and leading ahead of the data. *Nurse Leader.* 2021;19(5):483-488. doi:10.1016/j.mnl.2021.06.004