

Complexity Leadership Theory Integration into Nursing Leadership and Development in Addressing COVID-19 and Future Pandemics

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Abstract: Complexity Leadership Theory (CLT) is a new and revolutionary concept in addressing healthcare crises worldwide. Its relevance and applications were tested during the COVID-19 pandemic. However, no definite and encompassing research was done to apply it to nursing leadership. Thus, this study examines CLT integration into nursing leadership to address the challenges posed by the pandemic. Through a systematic review of literature from PubMed, Scopus, and Web of Science, relevant studies were analyzed to determine how complexity leadership theory was defined, conceptualized, and operationalized within nursing leadership context. The findings reveal that traditional hierarchical leadership models are insufficient in a dynamic crisis environment like the pandemic. Instead, CLT's framework which encompasses adaptive, administrative, and enabling leadership facilitates innovation, resilience, and effective interprofessional collaboration. Nurse leaders employing these strategies are better positioned to manage resources limitation, foster shared decision-making, and implement technological advancements in rapidly changing healthcare settings. Overall, this study underscores the potential of complexity leadership theory to transform nursing leadership practices by promoting continuous learning and empowerment, thereby enhancing crisis response and preparedness for future pandemics.

How to cite this paper:

Chan, C. B. (2025). Complexity Leadership Theory Integration into Nursing Leadership and Development in Addressing COVID-19 and Future Pandemics. *World Journal of Nursing Research*, 4(1), 87-97.
DOI: [10.31586/wjnr.2025.6103](https://doi.org/10.31586/wjnr.2025.6103)

Received: April 11, 2025

Revised: May 15, 2025

Accepted: May 31, 2025

Published: June 3, 2025



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Keywords: Nursing Leadership, Public Health, Complexity Science, COVID-19, Pandemic

1. Introduction

The COVID-19 pandemic which humanity experienced recently has caused unprecedented challenges and chaos in healthcare systems all over the world. The lack of information, resources, burnout, personnel shortages and other instabilities in the healthcare industry have underlined the necessity for an innovative but effective leadership style that can adapt and grow as the epidemic crisis develops and transforms into a new reality during and after the pandemic. Traditional theories of leadership emphasizing top-down and hierarchical approach may not be effective in addressing this complex crisis. As medical professionals try to empower teams, encourage cooperation, and create resilience in the face of continuous difficulties, new theories of leadership were developed and investigated [23].

Complexity Leadership Theory (CLT) is one such theory that stresses the need for an adaptive leadership in dynamic and uncertain environment therefore helping nursing leaders to inspire creativity and resilience among their teams. This strategy helps leaders to welcome complexity and uncertainty, thus fostering cooperative decision-making procedures that enable nurses to react appropriately to fast-changing healthcare needs

and so improve patient care results. Healthcare industries can foster a culture of lifelong learning and adaptation by including this theory into action, therefore arming their employees to negotiate the complexity of contemporary healthcare contexts with confidence and agility [38].

Rooted in complexity science, CLT is meant to solve the complex, adaptive, and sometimes erratic character of contemporary healthcare systems. It underlines the need for flexibility, collaboration, and capability of fostering innovation and resilience within complex adaptive systems (CAS). Unlike conventional leadership theories that concentrate on hierarchical structures and top-down decision-making, CLT acknowledges the connection between people and teams inside an organization and advises leaders to behave as enablers rather than controllers [21].

The framework CLT acknowledges the dynamic and interconnected nature of modern organizations. It is composed of three distinct but interrelated leadership types: adaptive, administrative, and enabling Leadership. Each type addresses distinct facets of organizational complexity making it a comprehensive strategy for developing leaders in the healthcare industry. Faced with difficult problems, adaptive leadership emphasizes creativity, learning, and adaptation inside companies. It underlines the need for leaders who can navigate uncertainty and guide initiatives for change. Administrative leadership is the structural and operational component of CLT including policy development, resource management, and guaranteeing the seamless operation of organizational systems. Lastly, enabling leadership emphasizes empowering people and teams, therefore promoting cooperation and establishing an environment that encourages employee well-being and participation [37].

The COVID-19 pandemic has underlined the significance of considering the global context, as well as the oppression and suppression of nursing leaders' values. The pandemic has resulted in a volatile, uncertain, complex, and ambiguous (VUCA) environment that requires complex and effective leadership [42]. The medical model, misogyny, and hierarchical difficulties within the profession have all shaped nursing leadership behaviors. As healthcare becomes more complex, there is an urgent need for effective and well-prepared nurse leaders. Nurse leaders must embrace evidence-based techniques and other skills to promote competency and establish infrastructures that foster expertise creation. They must be accountable for patient outcomes and have the power and resources to operate their units responsibly. Nurse leaders must develop and express a vision, foster strong relationships, and implement strategies and activities to attain common goals. Leveraging nursing's relevance in senior management is critical for success, and leaders who can grasp the complexities of crises and apply resourceful solutions are better suited to leading through such challenges [34].

1.1. Aim

This study aims to systematically identify, map, and synthesize how Complexity Leadership Theory is defined, theorized, and operationalized in nursing leadership and development during the COVID-19 pandemic and how it can be integrated in addressing future pandemics. It focuses on key conceptual frameworks and defining attributes of CLT, practical leadership strategies employed to address pandemic-driven complexities in healthcare, and barriers influencing the successful application of CLT in anticipation of future pandemics.

1.2. Research Questions

This study intends to answer the following research questions:

1. How is CLT defined, conceptualized and integrated into nursing leadership and development?
2. What are the practical implications of CLT in nursing leadership and development during and after COVID-19 pandemic?
3. How can CLT be utilized to address future pandemics?

2. Methods

2.1. Design

This study employs qualitative research design utilizing thematic analysis to examine available literatures on complexity leadership theory in nursing leadership and development during and after COVID-19 pandemic. The researcher followed the methodological steps proposed by (Arksey and O'Malley, 2005): (1) specifying the research question, (2) identifying relevant studies, (3) study selection, (4) charting the data, (5) collating and summarizing the findings, and (6) reporting the results. The study was also guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses to ensure a structured data collection.

2.2. Search Method

The researcher searched PubMed, Scopus and Web of Science since these databases are considered excellent sources for health and social studies. They also provide comprehensive access to peer-reviewed literature across a wide range of disciplines including detailed citation analysis, allowing researchers to easily find relevant studies and assess their relevance to the research questions. PubMed focuses primarily on biomedical sciences while Scopus and Web of Science offer a broader coverage encompassing both health and social sciences alongside other scientific disciplines. All three platforms primarily index peer-reviewed articles from reputable journals, ensuring the reliability and credibility of research findings. Moreover, each platform offers sophisticated search features, including keyword searches, subject headings, and filters to narrow down results based on specific research criteria.

The search process was conducted from February 22 to March 5, 2025, and it was run using a combination of keywords and Boolean operators adapted for each database. The core keywords included *Complex Leadership** (e.g., "complexity leadership," "complex adaptive leadership," "complex systems leadership"), **Nursing Leadership** (e.g., "nurse leader," "nurse manager," "nursing management") and **COVID-19 Pandemic** (e.g., "COVID-19," "SARS-CoV-2," "pandemic")

All retrieved references were exported to a citation manager (Zotero) and duplicates were removed. The articles were screened using their titles and abstracts for relevance according to the inclusion criteria. Articles passing the initial screening were retrieved in full text and assessed for eligibility.

Data from each included study was extracted using the literature review matrix template by Walden University Writing Center which includes author/date, theoretical/conceptual framework, research questions/hypothesis, methodology, analysis/results, conclusions, implications for future research and implications for practice. A thematic analysis was then conducted to analyze patterns and themes from each studies to come up results.

2.3. Study Selection

2.3.1. Inclusion Criteria

The study included published papers that explicitly mention 'complex leadership' or 'complexity leadership' in the publication title or abstract or that mention principles of

complexity theory (complex adaptive system [CAS], adaptive leadership, enabling, emergence, non-linearity) in association with 'leadership'.

The study defined the inclusion criteria as:

- **Publication type:** peer reviewed articles, theses and book chapters
- **Phenomenon of interest:** Complexity Leadership Theory
- **Context:** Nursing leadership; during and post COVID-19 pandemic
- **Period of publication:** between January 01, 2020, and March 05, 2025

2.3.2. Exclusion Criteria

The study excluded grey literature, commentaries, conference proceedings and book reviews. Papers discussing only other forms of leadership (transactional, transformational, engaging, distributed, shared or servant leadership) were excluded. All non-health papers are excluded from this review. Studies carried out in non-healthcare settings were also excluded.

2.3.3. Data Analysis

A thematic analysis framework was employed to systematically categorize and analyze how Complexity Leadership Theory (CLT) was defined, conceptualized, and applied in nursing leadership and development, particularly in the context of the COVID-19 pandemic.

The thematic analysis was conducted using the following six-step process:

1. **Familiarization with the Data:** The review on CLT in nursing leadership was thoroughly read and re-read to ensure a deep understanding of the content.
2. **Initial Coding:** Line-by-line coding was performed, identifying key concepts and categories related to CLT.
3. **Generating Initial Themes:** Initial codes were grouped into broader, meaningful themes representing the main aspects of CLT in nursing leadership.
4. **Reviewing Themes:** The initial themes were reviewed for clarity and consistency, ensuring they accurately represented the data.
5. **Defining and Naming Themes:** The final themes were clearly defined and named for coherence.
6. **Producing the Thematic Analysis Report:** A narrative synthesis was developed, presenting each theme with supporting data.

3. Results

In examining how CLT has been integrated into nursing leadership and development in response to the COVID-19 epidemic and future pandemics, there were reoccurring themes that appeared in the included literatures. These are the following:

3.1. *Defining and Conceptualizing Complexity Leadership in Nursing*

Complexity Leadership sees healthcare organizations as complex adaptive systems where many agents like nurses, patients, managers, and interprofessional teams interact in fluid and often unpredictable ways rather than stressing linear hierarchies [11].

In an integrative review, Wong et al. (2020) emphasized that nursing leaders who adopt complexity lens promote open communication, shared decision-making, and continuous learning. This conceptual shift from top-down oversight to collective problem-solving is essential in high-stakes environments. As such, nurse leaders function as facilitators of adaptive processes, enabling self-organization while still providing strategic direction [36]. Consequently, Complexity Leadership in nursing is characterized by

embracing ambiguity, fostering resilience, and guiding the team toward innovative practices that improve patient outcomes.

3.2. Adaptive Leadership and Resilience During COVID-19

A second theme highlights the importance of adaptive leadership which is an element intrinsic to Complexity Leadership Theory that navigates the unprecedented challenges posed by COVID-19. Many articles underscore how nurse leaders swiftly adapted protocols, managed scarce resources, and coordinated staff reassignments in response to rapidly changing public health guidelines [2,24].

This adaptive capacity was not just reactive but also proactive, seeking ways to prepare for subsequent infection waves and future emergencies [42]. For instance, some nursing departments established real-time feedback loops, where frontline nurses could communicate emergent challenges directly to leadership teams. These feedback loops exemplify complexity principles, as they allowed leaders to sense changes in the system, respond promptly, and revise protocols in a continuous cycle of improvement [24].

Resilience-building strategies were another prominent sub-theme. Leaders who adopted complexity-oriented approaches offered emotional and psychological support, promoted team cohesion, and fostered a sense of collective ownership over patient care. This not only minimized burnout but also fortified the healthcare workforce to sustain high-intensity operations [18].

3.3. Systems Thinking and Interprofessional Collaboration

Across the literature, a **systems thinking** mindset emerged as critical in unifying nursing with other disciplines, including medicine and public health. By acknowledging the interconnectedness of different units and specialties, nurse leaders can coordinate efforts more effectively and streamline patient care pathways [43].

During the peak of the pandemic, many hospitals formalized interprofessional task forces or rapid response teams [31]. Nurse leaders on these teams facilitated collaboration among various departments, ensuring that evolving guidelines were clearly communicated and that resources were allocated where needed most. This systems-based approach proved instrumental in addressing the complexity of COVID-19, as decisions in one area (e.g., ICU capacity) immediately impacted another (e.g., general wards, staffing, or PPE distribution).

“Emergence” which is the hallmark of complexity was frequently noted in these collaborative efforts [11]. As nurses shared real-time observations from the bedside, new treatment protocols, workflow configurations, or patient monitoring strategies emerged organically. Leaders then scaled these successful innovations across the organization, demonstrating how complexity-informed leadership recognizes and amplifies constructive bottom-up processes [22].

3.4. Empowerment and Shared Decision-Making

Another recurring theme is the significance of empowerment and shared decision-making in Complexity Leadership. In many studies, nurse managers who cultivated a supportive environment where staff could voice concerns, propose ideas, and co-create solutions were better equipped to handle crisis scenarios [41].

For instance, Sherman and Pross (2010) noted that empowered nurses showed higher job satisfaction, resilience, and commitment to quality care improvements. This empowerment, a key belief of CLT, aligns with the recognition that distributed intelligence across healthcare teams can foster more efficient and context-specific responses. By decentralizing some decision-making processes, nurse leaders leveraged

frontline expertise to enhance patient safety and operational efficiency during COVID-19 surges [16].

3.5. Innovation and Technological Adaptation

Innovation surfaced as an essential driver of complexity leadership, particularly when leaders harnessed digital technologies and data-driven tools. Telehealth platforms, electronic health records, and virtual care models rapidly expanded, requiring nurse leaders to develop new competencies and guide their teams in using these technologies [19].

CLT informed these transformations by encouraging nurse leaders to act as facilitators for cross-functional innovation. Studies highlighted the role of frontline nurses in ideating solutions such as virtual triage or remote patient monitoring which is leading to improved care access during lockdowns [31]. By acknowledging the complexity of incorporating new technologies into clinical workflows, leaders were able to experiment with pilot programs, gather feedback, and iteratively refine digital health interventions [11].

3.6. Sustaining Lessons Learned for Future Pandemic

Finally, the study points to an emerging consensus that lessons learned from the COVID-19 crisis should be systematically integrated into ongoing leadership development and organizational strategy [24]. Complexity Leadership principles—adaptability, collective problem-solving, and the capacity to navigate uncertainty—are equally relevant for future pandemics, natural disasters, or other large-scale disruptions [42].

Many articles advocate for institutionalizing these practices by revising competency frameworks in nursing education to include systems thinking and adaptive leadership skills [18]. Furthermore, investing in robust communication infrastructures, fostering a culture of continuous learning, and maintaining a flexible workforce are recurring recommendations for ensuring organizational resilience [41]. By doing so, nurse leaders will be better positioned to respond cohesively and innovatively to whatever challenges emerge.

4. Discussion

The COVID-19 pandemic has underscored the critical role of effective leadership in healthcare, particularly in nursing. Complexity Leadership Theory offers a robust framework for navigating the challenges posed by the pandemic and preparing for future crises. Even though COVID-19 pandemic was first detected in Asia, there were very few studies conducted on the use of complexity science in addressing the chaos caused by this pandemic in Asia. Nursing leaders were at the forefront in fighting this crisis and the information gathered from their experiences is very valuable to help others prepare for future pandemics. Thus, this section discusses how CLT can be applied into nursing leadership and development during pandemics.

4.1. Adaptive Leadership in Nursing Practice

Adaptive Leadership, a key component of CLT, focuses on fostering innovation, collaboration, and resilience in complex adaptive systems. During the pandemic, nurse leaders were required to adapt quickly to changing circumstances, such as shortages of personal protective equipment (PPE), shifting patient needs, and evolving public health guidelines. Studies highlight the importance of adaptive leadership in enabling nurse leaders to navigate these challenges effectively. For instance, nurse managers in Finland

emphasized the need for flexibility, problem-solving, and crisis communication skills to ensure the delivery of healthcare services during the pandemic [1].

To integrate adaptive leadership into nursing, programs should focus on developing competencies such as system thinking, innovation, and resilience. Simulation-based training, case studies, and scenario-based learning can help nurse leaders practice adaptive decision-making in dynamic environments. Additionally, fostering a culture of continuous learning and reflection can enhance leaders' ability to adapt to future challenges [7].

4.2. Administrative Leadership and Organizational Adaptation

Administrative Leadership within CLT emphasizes the importance of organizational structures, processes, and governance in supporting leadership practices. The pandemic highlighted the need for nurse leaders to navigate organizational complexities, such as managing remote work, ensuring staff safety, and maintaining patient care standards. Research indicates that administrative leadership played a crucial role in addressing these challenges. For example, nurse leaders in Australia removed organizational barriers, expanded working relationships, and implemented new models of care to respond to the pandemic effectively [5].

To integrate administrative leadership into nursing, programs should focus on developing competencies in strategic planning, policy development, and changing management. Nurse leaders should be trained to evaluate and improve organizational processes, such as workforce management, supply chain logistics, and communication systems. Additionally, training should emphasize the importance of collaboration between administrative and clinical leaders to ensure alignment between organizational goals and frontline practices [10].

4.3. Enabling Leadership and Empowerment

Enabling Leadership, the third component of CLT, focuses on empowering individuals and teams to achieve their full potential. During the pandemic, enabling leadership was critical for supporting the well-being and engagement of nursing staff. Studies highlight the importance of care behaviors, such as empathy, nurturing, and relational competencies, in fostering a supportive work environment. For example, nurse leaders who prioritized staff well-being, provided emotional support, and facilitated open communication were able to enhance team resilience and job satisfaction [26].

To integrate enabling leadership into nursing, programs should focus on developing relational competencies, such as communication, empathy, and emotional intelligence. Training should also emphasize the importance of shared leadership, where authority is distributed among team members to enhance collaboration and innovation. Additionally, programs should address the need for leaders to model behaviors that promote a culture of care, inclusivity, and professional governance [35].

4.4. Practical Implications for Nursing Leadership and Development

The integration of CLT into nursing leadership and development requires a multifaceted approach that addresses the unique challenges of the post-pandemic era. Key strategies include:

- **Competency-Based Training:** Training programs should focus on developing specific competencies aligned with the three components of CLT. For example, adaptive leadership training should emphasize innovation, resilience, and systems thinking, while administrative leadership training should focus on strategic planning and organizational adaptation. Enabling leadership training should prioritize relational competencies and empowerment [1,5,10]

- **Experiential Learning:** Experiential learning approaches, such as simulation-based training, case studies, and scenario-based learning, can provide nurse leaders with opportunities to practice CLT in real-world contexts. These approaches can enhance leaders' ability to navigate complex, dynamic environments effectively [14,28,40]
- **Continuous Learning and Reflection:** The pandemic has underscored the importance of continuous learning and reflection in nursing leadership. Training programs should incorporate reflective practices, such as journaling, debriefing sessions, and peer mentoring, to help leaders reflect on their experiences and identify areas for improvement [35].
- **Collaboration and Partnership:** Collaboration between nurse leaders, organizations, and policymakers is essential for addressing the challenges of the post-pandemic era. Training programs should emphasize the importance of building partnerships, sharing knowledge, and leveraging resources to support leadership development [25].
- **Technology and Innovation:** The pandemic has accelerated the adoption of digital technologies in healthcare. Training programs should incorporate the use of digital tools, such as mobile applications and virtual learning platforms, to support leadership development and enhance the delivery of care [26].

Table 1. Summary of CLT Application and Key Competencies

Component of CLT	Key Competencies	Application in Nursing Leadership and Development	Application During COVID-19	Application Post-COVID-19	Citations
Adaptive Leadership	Innovation, Resilience, Systems Thinking	Simulation-based training, case studies, scenario-based learning, reflective practices, continuous learning, and innovation workshops.	Fostering innovation and learning to respond to rapid changes in patient care and operational needs. Leading through uncertainty and building resilience to manage the emotional and psychological challenges of the pandemic.	Continuing to promote a culture of innovation and learning to prepare for future challenges. Developing strategies for leading through uncertainty and building resilience in anticipation of potential future crises.	[40, 14, 1, 28, 10]
Administrative Leadership	Strategic Planning, Organizational Adaptation, Policy Development	Workshops on strategic planning, organizational change management, and policy development; collaboration between administrative and clinical leaders.	Managing resources effectively to ensure the availability of staffing, equipment, and facilities. Streamlining processes and structures to enhance organizational efficiency and responsiveness.	Maintaining efficient resource allocation and supply chain management to support ongoing healthcare operations. Continuously improving processes and structures to ensure organizational agility and adaptability.	[39, 35, 10, 5]
Enabling Leadership	Relational Competencies, Empowerment, Emotional Intelligence	Training in communication, empathy, and emotional intelligence; shared leadership models, mentorship programs, and reflective practices.	Empowering nurses to take initiative and make decisions in rapidly changing environments. Fostering collaboration and communication within interdisciplinary teams to ensure coordinated care.	Creating a sustainable environment where nurses feel empowered and supported. Building on the lessons learned during the pandemic to enhance collaboration and communication within healthcare teams.	[35, 25, 26]

5. Research Gaps and Future Studies

The study offers a unique insight into Complexity Leadership Theory (CLT) and its application to nursing leadership and development. However, several overarching limitations and unanswered questions emerge. A recurring gap involves the limited scope of empirical validation. Although numerous authors emphasize the importance of adaptive, administrative, and enabling leadership [1,35,37], many of their findings derive from single-site studies, theoretical models, or anecdotal observations. Future research could broaden the database by conducting multi-site or cross-cultural investigations, ensuring that the proposed leadership competencies are generalized across different healthcare systems [26].

Table 1 highlights how CLT was applied during COVID-19 and how it might be extended post-pandemic, there is a lack of longitudinal studies tracking the sustained impact of these leadership practices over time [5,10]. Therefore, long-term research designs could offer clearer evidence of how CLT-based interventions influence patient outcomes, staff retention, or organizational resilience once initial crises subside [14].

Majority of the articles included underscore the significance of innovation, resilience, and empowerment but do not consistently detail quantitative metrics or validated tools for assessing these constructs [39,40]. It is recommended that standardized instruments or mixed-method approaches (combining qualitative insights with quantitative data) could strengthen the empirical evidence base, enabling comparisons across studies and clearer demonstrations of cause-and-effect relationships.

Studies conducted by Morse & Warshawsky (2021) and Udod et al. (2023) [25,35] mention training programs (simulation-based learning, workshops, mentorship) without fully detailing how the insights translate into routine clinical practice or everyday policy. In lieu of this, there is a need for implementation of complexity science frameworks to examine how CLT principles can be seamlessly integrated into clinical protocols, staffing models, or administrative workflows. This would help bridge the gap between “how leadership should work” and “how it actually works” in real-world nursing units.

Lastly, administrative leadership studies frequently mention strategic planning and resource management [39] but little is said about cost-effectiveness analysis or economic evaluations of CLT based interventions. It is imperative to include financial outcomes (e.g., operational savings, reduced turnover costs) which could bolster the case for adopting these leadership models in the long run, especially for stakeholders who must justify resource allocations [40].

6. Conclusion

Complexity Leadership Theory (CLT) provides a powerful lens for understanding and enhancing nursing leadership and development, especially in the face of dynamic challenges like a pandemic. By redefining leadership as a collaborative, adaptive process, CLT offers actionable strategies for fostering resilience, innovation, and effective interprofessional teamwork. Through a systems thinking perspective, nurse leaders can more adeptly coordinate complex interactions and guide their teams to respond in real time to changing conditions.

Empowerment and shared decision-making further underscore the importance of distributing leadership across hierarchical levels, allowing frontline nurses to actively shape solutions. The rapid uptake of digital technologies during COVID-19 also indicates that complexity thinking can spur meaningful innovation, enabling health systems to pivot under pressure. Finally, reflecting on the lessons learned during the COVID-19 pandemic, it will be helpful in designing sustainable and resilient healthcare systems capable of weathering future global health crises.

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