Resource orchestration in healthcare inter-organisational networks during crises

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ABSTRACT,
Crises pose significant threats to healthcare networks, particularly regarding their ability to orchestrate resources effectively and, thus, offer timely and quality patient care. While the COVID-19 pandemic was ultimately mitigated, upcoming crises stemming from the sharp increase in elderly population raise concerns about health systems' ability to ensure efficient resource orchestration. However, research on effective resource management within healthcare networks during crises is fragmented. This synthesis literature review aims to explore, synthesise, and establish a foundation based on insights from healthcare inter-organisational networks during the COVID-19 crisis. The review encompasses 13 studies across the business, healthcare, and public administration fields. It identified several themes contributing to effective resource orchestration and network outcomes. Based on the findings, a conceptual framework was developed, which clarifies not only how resources are allocated and managed by healthcare networks, but also emphasises that the synchronisation of resources, network actors, and inter-organisational actions is needed to achieve positive network outcomes. The findings highlight the importance of collaboration, coordination, and external integration for overcoming challenges associated with resource scarcity in healthcare inter-organisational networks during crises. This study provides solid ground for future inquiry and practical implications.

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Keywords
Inter-organisational networks; Healthcare; Resource orchestration; COVID-19; Resource shortages; Inter-organisational collaboration

1. INTRODUCTION

Healthcare networks encountered difficulties such as shortages, increased costs, and problems in resource allocation during the COVID-19 pandemic. The increased demand and limited supply of medical equipment and supplies during this period resulted in shortages, leading to poor health services (Tip et al., 2022). Multiple examples during the COVID-19 crisis highlighted the significance of efficient resource orchestration within healthcare networks (Baltas et al., 2022; Queiroz et al., 2022; Ranney et al., 2020; Sigala et al., 2022). Moreover, the sharp increase in elderly people challenges health systems across the world and represents an upcoming crisis for healthcare networks. According to the Organization (2024), the number of people aged over 80 years or older is projected to triple between 2020 and 2050, reaching 426 million.

COVID-19 pandemic represents an entirely different crisis compared with other types of crises provoked by natural disasters or other type of viruses, which happen in a localised bounded geographical area (Ivanov, 2020). Ivanov (2020) presents that COVID-19 affected supply chains globally due to the virus spreading at a rapid pace in various geographical regions and requiring the stoppage of activities and, thus, causing supply chain disruptions. Moreover, these disruptions affected the ability of resources to be allocated effectively to mitigate the pandemic.

The changes experienced over the past years due to the COVID-19 pandemic led to growing attention in understanding the implications of such a crisis within networks (Queiroz et al., 2022). The shortages of ventilators and personal protection equipment (PPE) during the COVID-19 pandemic demonstrated the importance of allocating resources in times of crisis (Ranney et al., 2020). Additionally, the supply chain was severely affected, and PPE was considered a strategic product category (Sigala et al., 2022). In their paper, Baltas et al. (2022) emphasise the need for resource orchestration in dealing with the effects of the pandemic and planning future disruptions. The prospect of future crises and the insights gained from previous ones, enables the understanding that strategic resources need to be allocated with great attention by inter-organisational networks to ensure efficient and effective treatment and care to patients.

How actors interact within these complex healthcare networks influence not only their ability to allocate resources, but also the overall system effectiveness. Ritter and Gemünden (2003) highlight that humans, not organisations, build relationships and networks through collaboration. Hospitals are critically affected by shortages during crises, requiring new inter-organisational approaches for careful resource management and timely patient care. In healthcare networks, the failure to meet the demand for patient care causes complications in treating patients and puts pressure on the medical staff, creating long waiting lists and poor service quality.

Considering the current trends, the gravity of future crises, and the need for adequate resource allocation in healthcare inter-organisational networks, the following research question will be addressed: *How do healthcare inter-organisational networks orchestrate resources during crises?*

This research question is relevant as it can provide an overview of how medical resources are orchestrated in healthcare crises, as well as a set of recommendations for supply chain and procurement specialists in healthcare networks. Furthermore, the emergent development of literature regarding networks' response to the COVID-19 crisis provides a foundation for tackling this research question. The scope of this research is to examine healthcare networks and resource orchestration, with a focus on supply chain and procurement practices, within the healthcare sector, specifically focusing on the responses during healthcare crises such as the COVID-19 pandemic.

This review takes a synthesis approach (Krlev et al., 2025) to expand the understanding of supply chain and procurement practices that were employed during COVID-19 to address resource orchestration. Moreover, a synthesis review on this topic is necessary to address the emerging literature that is fragmented and work toward integration. Synthesizing this fragmented knowledge might foster initiatives for improving healthcare inter-organisational networks' readiness and response capabilities in future emergencies. Therefore, the aim of this study is to provide an overview of resource orchestration in healthcare networks during crises by describing the major actions taken, highlighting the missing links, and offering future insights. By identifying the antecedents and outcomes of how resources were managed, this study adds to the resource management literature.

The paper is organised as follows. Section 2 presents the theoretical background, which explains network formation, inter-organisational networks, and a summary of the Actors, Resources, and Activities model, as well as the Resource Orchestration Theory. Section 3 describes the research methodology and the research process. In Section 4, the findings are summarised, while Section 5 is represented by the discussion of the results and practical and theoretical implications. Section 6 presents the limitations of the study and future research directions. Finally, Section 7 synthesises the main conclusions.

2. THEORETICAL BACKGROUND

Considering the paper's aim, specifically to identify how healthcare networks orchestrate resources during crises, one of the key relevant theories that will be used throughout the paper is represented by inter-organisational network theory. Moreover, key to understanding the relevance of the topic are studies related to disruptions in healthcare, especially the recent ones revolving around the COVID-19 pandemic.

To build a more robust theoretical foundation for this paper, the Actors, Resources, and Activities (ARA) model and the Resource Orchestration Theory (ROT) will be integrated to complement each other. While the ARA model offers a structured mapping of the network's actors, resources, and activities, the model is relatively static and fails to explain how organisations manage and reconfigure these elements. Therefore, by incorporating ROT, a dynamic perspective on how resources are intentionally orchestrated to achieve competitive advantage, will be added. Together, the ARA model and the ROT, capture both the configuration and the orchestration of resources.

The following sub-sections will begin by introducing the ARA model. Afterward, the ROT will be discussed. Finally, inter-organisational networks will be explained in the context of healthcare and crises.

2.1 Actors, resources, and activities model

The actors, resources, and activities (ARA) model, proposed by Hakansson and Johanson (1992), represents a model that explains how organisations create and interact within networks. In their model, Hakansson and Johanson (1992) state that actors, resources, and activities form structures that can be defined as networks. Actors perform activities and control resources. Activities can be defined as the combination, development, exchange, or creation of resources through the utilisation of other resources. Networks are composed of heterogeneous resources, and changes in the network trigger further change.

The ARA model helps in understanding the structure, formation, and evolution of inter-organisational networks in healthcare. For

example, in the scenario created by the COVID-19 pandemic, the changes in demand for personal protection equipment (PPE) lead to shortages of such equipment in healthcare supply networks and, thus, to the formation of new networks. Due to this challenge, networks composed of buyers emerged to tackle the allocation of resources and conduct a coordinated purchasing activity (Peters et al., 2023; Peters, 2021).

Resources become valuable as they are integrated and combined by actors (Jaakkola & Hakanen, 2013). Moreover, value co-creation is achieved through the combination of various resources of multiple actors, which individual actors alone cannot deliver. During crises, this point is made clear by the fact that, only through the collaboration of various actors within the healthcare inter-organisational network, resources can be made available, bundled, and allocated correspondingly to deal with the challenges associated with crises. Throughout the pandemic, the availability of scarce resources was ensured by the combination of resources and efforts of multiple actors (Skipworth et al., 2023). Some of these actors were acting outside of their traditional networks and markets, and without their collaboration and pooling of resources, the unavailability of scarce resources would have been prolonged.

2.2 Resource orchestration theory

In their study, Tip et al. (2022) demonstrated how during crises, due to scarcity of resources, items that were considered non-critical, such as PPE, become temporary bottleneck items. Thus, resources that were considered low in supply risk before the COVID-19 pandemic shifted to a high supply risk category. These changes in product categories during crises imply that resources need to be managed differently, and their allocation by healthcare networks becomes pivotal for ensuring patient care. The previous COVID-19 crisis and the upcoming crises highlight the need for understanding how widely used theories, as well as emerging theories, could shed light on efficient ways of resource orchestration in healthcare networks. Craighead et al. (2020) proposed ten theories that they consider to be influential tools to understand what happened during the pandemic, the organisational responses, and the adjustments made to supply chain structures and processes in case of future crises. A critical tool suggested by Craighead et al. (2020) for understanding supply chain adjustments during pandemic times is represented by the Resource Orchestration Theory (ROT).

Proposed by Sirmon et al. (2011), ROT was developed as a result of the limitations of Resource-Based Theory (RBT), and it can be seen as an extension of the RBV. ROT emphasises the role of the manager in orchestrating resources through managerial actions (structuring, bundling, and leveraging) (Sirmon et al., 2011). Research by D'Oria et al. (2021) supports the interdependence of resource possession and resource orchestration actions, marking them as "being determinants of performance advantages". Chadwick et al. (2015) state that the combination of resources, capabilities, and managerial acumen results in superior performance. Furthermore, in their study, Sirmon et al. (2007), propose a resource management framework that addresses the managerial actions involved in achieving competitive advantage and, thus, creating value. In healthcare, the ability of networks to allocate resources effectively to provide timely and qualitative patient care represents the "competitive advantage".

Researchers have shown an increased interest in using the ROT recently due to its usefulness during dynamic periods in healthcare (Baltas et al., 2022; Queiroz et al., 2022; Yu et al., 2023). Skipworth et al. (2023) contribute to the ROT literature by extending it to a network-level and by explaining how organisations at the network-level orchestrate their resources differently, outside of their traditional markets, due to significant uncertainty and a common sense of threat. Yet, research demonstrating how resource orchestration actions can be applied to healthcare inter-organisational networks during crises remains limited.

2.3 Inter-organisational healthcare networks

Provan et al. (2007) state that network members can be connected through various flows such as information, materials, financial resources, services, and social support. Healthcare supply networks connect members through the flow of information such as inventory and forecast data, materials such as medical equipment and devices, services such as waste disposal, financial resources such as payment of suppliers and government funding, and social support such as training from suppliers regarding equipment.

Inter-organisational networks can be defined as a set of actors with recurring ties that join together around a shared goal or concern (Oliver & Ebers, 1998). Ritter and Gemünden (2003) mention that inter-organisational networks can be described in terms of the actors, activities, and resources which influence each other. Healthcare networks are composed of actors such as hospitals, academic hospitals, nursing homes, suppliers, the government, policy makers, universities, etc. The resources that circulate through these networks are both tangible, such as medical devices, hospital beds, and personnel, and intangible, such as knowledge and information. The activities that take place within the inter-organisational network not only influence it, but also transform resources (Ritter & Gemünden, 2003).

2.4 Inter-organisational networks during crisis

Healthcare supply chains are particularly critical during crises and emergencies, as disruptions in these networks can have severe consequences for the networks's actors and patients (Zamiela et al., 2022). COVID-19 represented a global health emergency (Sohrabi et al., 2020) that significantly affected supply networks across the globe, especially healthcare supply networks (Zamiela et al., 2022).

Oliver and Ebers (1998) emphasise that networks emerge due to them having a shared goal or concern. In healthcare, during crises, multiple organisations such as hospitals, governments, and suppliers are brought together by the shared goal of mitigating crises. During the COVID-19 pandemic, a coordinated response to control the spread of the virus and manage resources was assured through the inter-organisational collaboration of multiple members from different sectors and industries. Tatham and Kovács (2010) state that when disasters occur, organisations unite rapidly to respond accordingly. Thus, as a response to crises, multiple networks emerge for the good coordination of actors, resources, and activities. Disasters need both a quick response and effective relief, and these newly formed inter-organisational networks help to overcome the challenges of rapidly evolving situations. Adequate relief is dependent on how quickly the supplies are procured, transported, and received.

Skipworth et al. (2023) explained how organisations at the network-level orchestrated their resources differently, outside of their traditional markets, due to significant uncertainty and a common sense of threat. They highlighted that, throughout the pandemic period, new networks emerged to mitigate the scarcity of critical supplies such as PPE. For example, in their paper, Skipworth et al. (2023) mention that a hospital, a manufacturing company, and a university joined forces to manufacture and deliver ventilators. Another network that emerged in the Netherlands during COVID-19 consisted of buyers who

coordinated their efforts to efficiently procure medical products, including ventilators, PPE, and tests (Peters et al., 2023; Peters, 2021).

Zamiela et al. (2022) emphasised in their paper that healthcare supply chains are essential for human life, and thus the resilience of such networks is critical, and they must be strong in the light of any disruption. Furthermore, the researchers demonstrated the importance of resources in maintaining resilient and effective healthcare supply chains during crises and disruptions. The COVID-19 crisis has completely transformed the management of resources in healthcare networks. However, there is a lack of consolidated evidence regarding which approaches taken within inter-organisational networks were the most effective in dealing with this crisis. Therefore, a synthesis literature review is required to synthesise the approaches taken during COVID-19, assess their effectiveness and provide guidelines for future crises.

3. METHODOLOGY

The aim of this research is to identify how healthcare inter-organisational networks use resources to respond to crises. Due to the importance of comprehending the actions that need to be taken for efficient resource management during health crises, this paper will focus on resource orchestration during the COVID-19 pandemic. The focus is specifically on this crisis due to it being different from other types of crises. Moreover, due to the fragmentation of research conducted in response to the COVID-19 pandemic, this paper aims to provide an overview of the patterns emerging from resource orchestration during crises within healthcare inter-organisational networks. Thus, the synthesis literature review focuses on studies assessing the collaboration within inter-organisational healthcare networks, their supply chain management, and resource allocation in the healthcare sector during health emergencies such as the COVID-19 crisis. Moreover, there are different theories that have great potential in aiding the understanding of how healthcare networks responded to the pandemic. Thus, this research will focus on identifying the theories employed within networks.

Systematic literature reviews provide a thorough method that aims to provide an integrated view of the existing knowledge (Palmatier et al., 2018). However, this research method has some limitations, such as selection bias and lack of comprehensiveness, and thus, to overcome this challenge, appropriate search strategies will be planned, and a comprehensive set of synonyms will be used (Haddaway et al., 2020). Based on the paper of Tranfield et al. (2003), to perform the literature review, the following three steps were taken: planning the review, conducting the review, and reporting and dissemination.

3.1 Planning the review

In this first stage, given the emergent development of literature on inter-organisational networks' response to COVID-19, the need for conducting a synthesis review on healthcare inter-organisational network allocation of resources was identified. Afterward, a review protocol was developed, depicting the used databases, inclusion and exclusion criteria, keywords, and used search filters.

The queried databases were Web of Science, Scopus, and PubMed. Web of Science and Scopus, all of which provide a wide range of management and healthcare journals, while PubMed only covers healthcare journals. A scoping search was conducted to determine the scope of the relevance and size of the literature (Tranfield et al., 2003). The key words identified were specifically looking at inter-organisational healthcare networks, resource allocation, and the pandemic. Thus, included were: "inter-organisational network", "health network", "health network system", "health-care network", "healthcare network", "hospital supply chain", "healthcare supply network", "resource orchestration", "resource allocation", "resource mobilization", "resource management", "resource coordination", "purchasing", "procurement", "supply chain", "COVID-19, "coronavirus", "coronavirus disease 2019", "SARS-CoV-2", "COVID-19 pandemic", and "public health emergency". Including "purchasing", "procurement", and "supply chain" as key words strengthen the focus on the supply chain and procurement practices taken to acquire and manage resources. Furthermore, these key words emphasise the coordination among different actors within healthcare networks to orchestrate resources.

The criteria for inclusion were that studies had to be conducted after 2018, so the COVID-19 pandemic would have taken place, had to include healthcare networks, systems, or organisations, had to describe or analyse how the resources were allocated, managed or orchestrated during the pandemic, and written in English. This paper included only peer-reviewed studies and book chapters published in journals. Editorials, reports, commentaries, and viewpoints were excluded due to them not being transparent regarding their methodology. The studies that were discussing or analysing individual patient treatment were excluded as they were out of the scope of this paper. Furthermore, the articles were limited to covering the subject areas related to business, healthcare, and public administration. Table 1 presents the applied search filters, and the inclusion and exclusion criteria. The search strings used for each database can be seen in Table 2 in Appendix.

Table 1: Filters, inclusion and exclusion criteria

Filters	Inclusion criteria	Exclusion criteria
• Publication year: after 2018 • Language: English • Research areas: business, public administration, and healthcare • Document type: peer-reviewed journal	• Articles focusing on resource allocation or management in healthcare • Articles about inter-hospital or inter-organisational collaborations, actions, or networks • Articles about healthcare networks • Articles investigating COVID-19 • Articles with a ROT perspective on healthcare • Articles with a focus on SCM	• Articles investigating HRM • Articles investigating the COVID-19 progress • Articles investigating the integration of IS or their efficiency • Articles investigating the impact of natural disasters • Articles focused on scheduling • Articles talking about the digitalisation of the SC • Articles focusing on other diseases or pandemics

3.2 Conducting the review

At the beginning of May, 03.05.2025, the search was conducted on the above-mentioned online databases. A single Boolean search string was constructed to encompass the five conceptual elements of this research: healthcare networks, COVID-19 crisis, resource orchestration, healthcare, and supply chain. The fifth element, supply chain, along with procurement, was included in the search string to capture the practices related to the effective acquisition, allocation, and management of the flow of resources across the supply chain. The search string was created by using quotation marks for exact phrases, "OR" for grouping synonyms, "AND" for ensuring that results contained at least one term from each block. The "NEAR/0" operator was used to require that a term must appear immediately next to the other term. For example, "((healthcare OR health) NEAR/0 network$)" finds documents where the terms "healthcare" or "health" are directly adjacent to any form of the term "network". The "$" symbol ensured a match with any word starting with a given root.

Moreover, the "*" symbol ensured that words' plurals were included. The final search string used for each database was: *"("COVID-19" OR covid OR coronavirus OR "coronavirus disease 2019" OR "SARS-CoV-2" OR "COVID-19 pandemic" OR "public health emergency") AND (resource$ NEAR/0 (allocation$ OR management OR orchestration OR coordination OR mobilization)) AND (purchas* OR procur* supply chain$) AND (healthcare OR health OR (health NEAR/0 (system$ OR care)) OR (inter-organizational NEAR/0 network$) OR ((healthcare OR health) NEAR/0 network$) OR network$)".*

The search string was adapted to match the search requirements of each database. Table 2, in the Appendix, presents the adaptation of the above search query for each database.

The initial search, done using the filters presented in Table 1, retrieved 91 results from Web of Science, 69 results from Scopus, and 6 results from PubMed. The retrieved literature from each database was imported to Covidence, a reference manager, which detected and removed the duplicates. After removing 36 duplicates, the remaining 130 records were exported to Excel for further evaluation of the title, abstract, and text screening.

Each article's title and abstract were reviewed in Excel based on the predefined inclusion and exclusion criteria depicted in Table 1. Records that did not meet the criteria were marked as excluded, and the reasons for exclusion have been documented in the Excel file. Based on the title and abstract review, 37 papers was included in the next phase, represented by a full-text review. Literature that successfully passed the title and abstract screening based on the inclusion and exclusion criteria were further evaluated by examining the full text. The assessment was documented in Excel, noting whether the studies were included or not, along with the inclusion or exclusion reason. After reviewing the full text of the papers, 13 papers were selected for the synthesis literature review. Figure 1 depicts the overview of the search process.

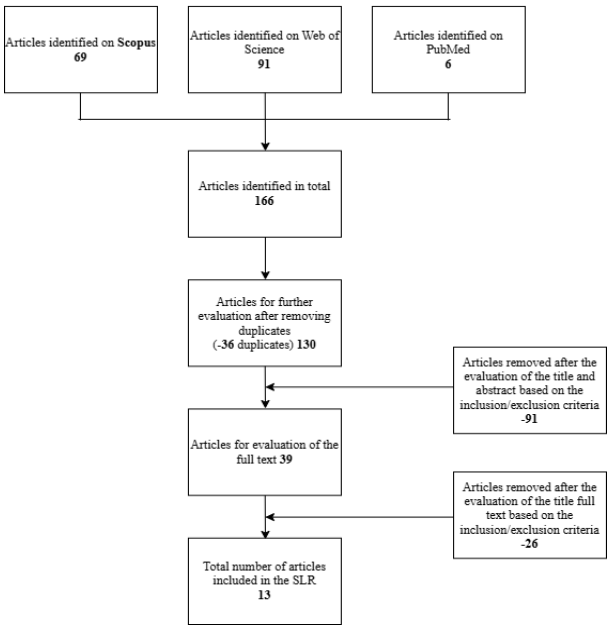

Figure 1: Flow chart of search process

3.3 Analysis of the selected articles

Based on the paper of Tranfield et al. (2003), a two-stage report was produced. First, a descriptive analysis of the field was done through the usage of research methods, journals, and theoretical background. The two-stage report also includes a thematic analysis to identify and outline the key relevant themes and concepts within the literature.

4. FINDINGS

Table 3 in the Appendix represents an overview of the selected papers for the synthesis literature review. It presents the journals, applied methodologies, research type, main objectives, and main findings for each selected article. In the following sections, the descriptive analysis, as well as the thematic analysis of the mentioned papers, will be provided.

4.1 Descriptive analysis

4.1.1 Research methods used

The literature employed various methods such as scoping review, online survey, integer programming, semi-structured interviews, etc. The applied methodologies for each study are depicted in Table 3 in the Appendix. The methodological choices made are presented in Figure 2. Most articles (92.31%) are classified as empirical, with only one (7.69%) classified as theoretical. A quantitative approach was adopted by 7 (58.33 %) of the empirical articles, while 5 (41.67%) empirical articles used a qualitative approach.

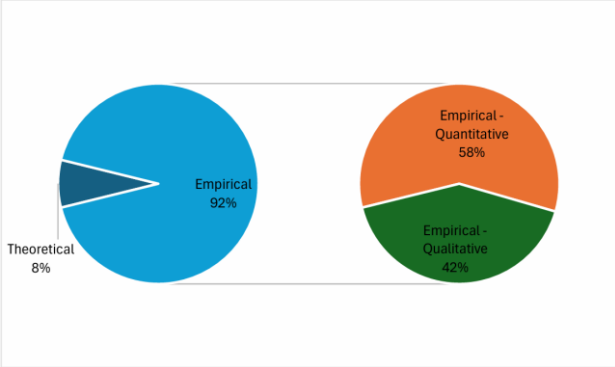

Figure 2: Methodologies applied by the included articles

4.1.2 Journals of the reviewed articles

This sub-section assesses the journals of the reviewed articles. Table 4 in the Appendix presents the distribution of the selected articles across the academic journals, their fields, and rankings according to the Academic Journal Guide (AJG) 2024, if available (7 out of 13 articles). Out of the articles included in the synthesis literature review, two are published in the same journal, while the others are published in a different journal each. Thus, there is a high fragmentation of the topic, with no journal dominating the dataset.

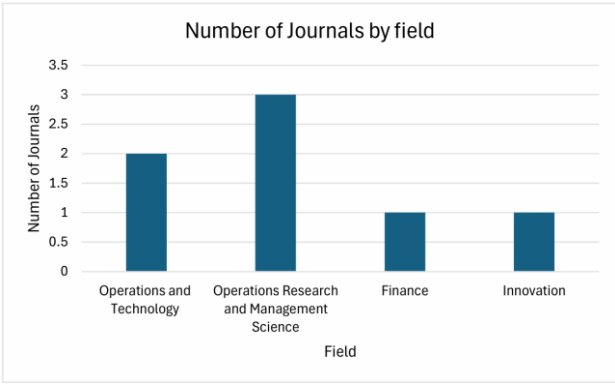

Figure 3: Number of journals by field

The identification of the journal fields of the selected papers was done by checking the AJG. Assessing the fields was possible only for 7 journals that were included in the AJG. There are 3 out of 7 (42.88%) journals that are part of the Operations Research and Management Science (OR&MANSCI) field, making it the

most represented category. The Operations and Technology (OPS&TECH) category accounts for 2 out of the 7 journals (28.57%), being the second most represented category. The other fields remaining, Finance (FINANCE) and Innovation (INNOV), are represented by one journal each. Overall, there is an orientation toward research focused on operations, as can be seen in Figure 3.

Just as in the assessment of the fields, the evaluation of the ranking of the journals was possible only for 7 journals included in the AJG. The ranking provided by the AJG aids in understanding the quality of the articles. Most articles, 5 out of 7 (71.43%), have a ranking equal to or greater than 3, indicating that they can be considered of medium to high quality, as can be seen in Figure 4.

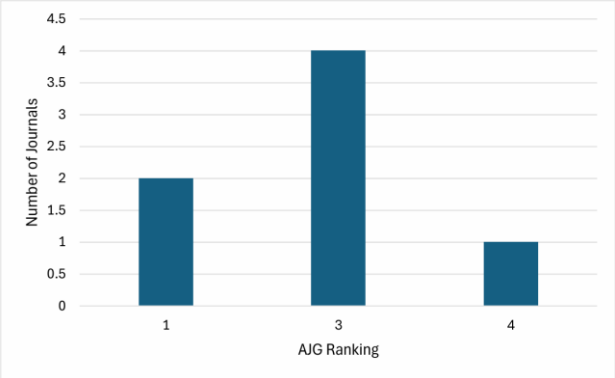

Figure 4: Number of journals per AJG ranking

4.1.3 Theories, frameworks and models in the reviewed articles

The theories, frameworks, and models employed by the selected articles to guide their research can be categorised into three domains: resource management and strategic decision-making, supply chain and risk management, and optimisation models. Table 5 in the Appendix, presents the theoretical background of the papers, as well as their corresponding category. The first category, resource management and strategic decision-making, refers to the theories and frameworks that address how resources are managed and allocated, such as RBV, ROT, Dynamic capabilities, Factor market rivalry Framework (FRM), Kraljic Matrix, and Resource allocation during health crises. The second category, supply chain and risk management, is composed of theories, frameworks and models that handle disruptions, resilience and risks in healthcare during crises, such as Network governance theory, Supply chain/Hospital resilience, Disruptions in operations and supply chain management, Crisis-Induced vaccine supply chain, Insurance applications of epidemic models and capital allocation, and Risks measures in healthcare logistics management. The last category, optimisation models, refers to models that aid in decision-making regarding healthcare. An example of an optimisation model employed is represented by the multi-stage stochastic programming (MSSP) approach, specifically the study of Fattahi et al. (2023). Out of the 13 papers included in the systematic literature research, 6 papers did not present a theoretical background.

The analysis of the reviewed literature reveals that there is a preference for a specific underpinning category that the researchers employed. The preference is represented by the usage of the resource management and strategic decision-making category. Out of the 13 papers, 6 use this category, such as Betto and Garengo (2023); De Luca et al. (2025); Fattahi et al. (2023); Mwije (2024); Skipworth et al. (2023), and Tip et al. (2022). The second preferred category is supply chain and risk management, with 3 out of 13 papers using it (Betto & Garengo, 2023; Chen et al., 2021; De Luca et al., 2025). There is only one paper employing the optimisation model category, represented by Fattahi et al. (2023). Some papers combine two theories or models, specifically, 3 out of 13 articles. Combining these categories contributes to addressing a broader range of layers of the problem and, thus, offers a comprehensive understanding. For example, De Luca et al. (2025), use the RBV theory to describe how resources and capabilities interact, integrate, and reinforce each other to achieve hospital resilience during crises such as COVID-19. Other papers combining categories are articles by Betto and Garengo (2023) and Fattahi et al. (2023).

4.2 Thematic analysis

This section of the paper presents the thematic findings of the synthesis literature review, with the aim of identifying similarities and patterns across the reviewed papers. Moreover, a conceptual framework is presented to understand the relationship among these concepts and, thus, to answer the research question. To derive the themes of the selected literature, codes were created using a deductive and an inductive, holistic coding approach. The coding was done manually.

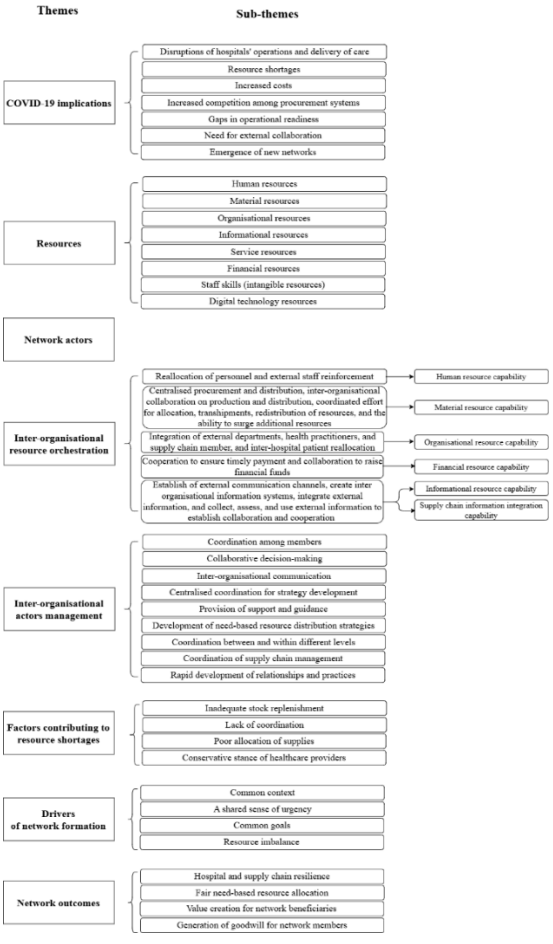

Figure 6: Themes and sub-themes

According to Miles (2013), deductive coding refers to the development of codes based on the researcher's conceptual framework, research questions, hypothesis, problem areas, or key variables. Thus, a set of codes were constructed beforehand based on the ARA model presented in Section 2.1. The derived codes are represented by: "ACTORS", "RESOURCES", and "ACTIVITIES".

The inductive coding approach refers to the development of codes during the data collection period (Miles, 2013). This inductive coding method allowed the development of codes

during the analysis of the selected papers. Moreover, instead of fragmenting the literature into smaller units, a holistic coding approach was utilised. Miles (2013) defines holistic coding as a method that allows the coding of a "large unit of data" such as full paragraphs or the entire study, to determine the meaning of the general content. Examples of the codes created using the inductive holistic coding approach are represented by: "SUPPLY AND DEMAND ISSUES", "NEED FOR EXTERNAL COLLABORATION", "CENTRALISED PROCUREMENT", etc.

Based on the developed codes, the following eight themes emerged: COVID-19 implications, resources, inter-organisational actions for orchestrating resources, network actors, inter-organisational orchestration actions, drivers of network formation, factors contributing to the shortage of resources, and network outcomes. Figure 5 in the Appendix offers an overview of how the themes were developed. Each theme comprises several sub-themes that capture the complexity of the concepts. Figure 6 depicts the developed themes and sub-themes, while Table 6 in the Appendix presents the definitions of the sub-themes.

These themes can be divided into internal and external factors of the inter-organisational network environment. The external elements, specifically COVID-19 implications, drivers of network formation, and factors contributing to the shortage of resources, shape the environment in which the inter-organisational network operates, creating opportunities and constraints. On the other hand, internal factors, represented by the remaining themes, refer to the factors composing the network and the managerial dimensions that result in networks being able to navigate external factors.

In the following sub-sections, the definitions of the themes will be presented by also categorising them in factors from external or internal inter-organisational environment, with the aim of ensuring a thorough grasp of their implications and connections. The conceptual framework (Figure 7) will further clarify the relationships between these internal and external inter-organisational network factors.

4.2.1 External factors of the inter-organisational environment

External factors influence inter-organisational networks in terms of their emergence, evolution, and adaptation. As these factors shape the environment in which the networks operate, they further lead to changes in inter-organisational networks. These external factors are represented by COVID-19 implications, drivers of network formation, and factors contributing to the shortage of resources.

The first theme, COVID-19 implications, revealed the vulnerabilities in the supply chains all over the world and gaps in the preparedness of countries to respond to a health crisis of such magnitude. The pandemic caused significant resource shortages determined by increased demand and decreased supply (Betto & Garengo, 2023; Chen et al., 2021; Dagenais et al., 2023; De Luca et al., 2025; Fattahi et al., 2023; Li et al., 2021; Santini, 2021; Skipworth et al., 2023). These shortages, along with the surge in patient flow, disrupted hospitals' operations and delivery of care and led to increased costs and competition for limited supplies. Therefore, the need for external collaboration proved to be a solution to mitigate not only the shortages but also the healthcare crisis. As a result, new healthcare networks formed both with actors that were outside of the traditional healthcare industry and actors that are usually tasked with disaster response. These emerging networks aimed to mitigate the mentioned challenges and orchestrate resources to deliver proper healthcare.

The second theme, drivers of network formation, emphasises the motivating factors for cooperation. The common context created by the COVID-19 crisis, shared sense of urgency driven by uncertainty and the need for developing solutions, common goals, and resource imbalances constrained organisations and enforced the need for a collective response. These inter-organisational networks formed with a common aim to mitigate the challenges created by the crisis.

The third theme presents several factors that contributed to the shortages of resources during the COVID-19 crisis. These factors hindered the mitigation of the pandemic by individual organisations and stressed the importance of inter-organisational actions. Identified as the key drivers of resource shortages, along with the assessed studies, are the following factors: inadequate stock replenishment, lack of coordination, poor resource allocation, and conservative stance of healthcare providers.

Overall, three external factors significantly influenced the landscape of inter-organisational networks, as they shaped the emergence and evolution of these networks. These factors contributed to pressuring non-traditional healthcare organisations to join and adapt their operations to mitigate the healthcare crisis. The external factors of the inter-organisational environment are further presented in Table 6 in the Appendix.

4.2.2 Internal factors of the inter-organisational environment

Internal factors represent elements that can be controlled and influenced by the inter-organisational network. These include the themes that compose the inter-organisational network, such as network members, resources, and inter-organisational actions, as well as the themes that encompass key managerial dimensions that shape how the components are orchestrated, such as inter-organisational orchestration of actors and inter-organisational resource orchestration. These internal elements are interconnected and directly influence the last theme, network outcomes. Together, the internal factors represent the networks' ability to effectively adapt to external challenges, which will be further illustrated in the conceptual framework.

In line with the ARA model developed by Hakansson and Johanson (1992), resources, network actors, and inter-organisational actions represent the components of inter-organisational networks. During the COVID-19 pandemic, resources became a cornerstone in delivering timely, efficient care to patients and in providing adequate protection to healthcare workers. The orchestrated resources during this health crisis could be categorised as human, material, organisational, informational, service, and financial resources, as well as staff skills and digital technologies. These resources are further summarised in Table 6 in the Appendix.

The network actors theme comprises the multitude of actors that form the inter-organisational network and mobilise their efforts towards a common goal. The papers revealed that the identified inter-organisational networks were composed of healthcare providers such as medical centres, hospitals, and clinics, the government, regulatory bodies, local, regional, or national authorities, a central procurement entity, suppliers, non-governmental organisations, etc.

Inter-organisational actions represent the coordinated efforts of network actors. The consensus resulting from the assessed papers indicates that these actions are represented by coordination, collaboration, joint planning, and strategy development. The effectiveness of such actions facilitates the alignment of efforts across organisations during health crises such as COVID-19.

The managerial dimensions reflect the actions taken to orchestrate resources and actors within inter-organisational

networks. The identified themes, inter-organisational orchestration of resources and actors, align with the principles proposed by the ROT (Sirmon et al., 2007). Sirmon et al. (2007) state that managers play a critical role in creating competitive advantage. The linkage between these actions and ROT will be further explored in the discussion section.

The inter-organisational actions for resource orchestration represent the coordinated efforts made by the inter-organisational network actors for efficient and fair resource orchestration. The creation of inter-organisational networks, composed of various actors, enhances the resource pooling power, which can further lead to better crisis responses. These actions taken for managing resources were related to the development, production, allocation, reallocation, and distribution of resources in the inter-organisational network. Through the employment of such efforts, networks ensured that the health crisis could be mitigated or at least kept under control.

Assessing the selected studies, the need for aggregated responses to orchestrate material resources emerged. For orchestrating human resources actions such as the reallocation of personnel and external staff reinforcement are needed., On the other hand, for orchestrating material resources, centralised procurement and distribution, resource redistribution, and other similar actions, as presented in Table 6, are needed. To orchestrate organisational resources, external departments, health practitioners, and supply chain members needed to be integrated, resulting in the change of the internal configuration, governance model, and procedures of organisations. Moreover, the changes made to the organisational resources, led to inter-hospital patient reallocation. The actions taken to orchestrate informational resources are represented by the establishment of external communication channels and the creation of inter-organisational information systems used to share information across organisations. Finally, financial resources were orchestrated through actions such as cooperation the of insurance providers to ensure timely payment and the mobilisations of network actors to raise financial funds.

The ability of networks to model the resources and structure their orchestration, transforms these mentioned actions into capabilities. The emerging capabilities are represented by human, material, organisational, informational, financial, and supply chain information integration capabilities. Table 6 in the Appendix offers an overview of the inter-organisational actions taken to orchestrate resources in the networks, and their corresponding capability. These capabilities as well as the inter-organisational actions taken to manage network actors, will be discussed in the Conceptual framework sub-section.

The actions taken to orchestrate network actors' activities required robust coordination to ensure that the goals, objectives, and values of the inter-organisational members are aligned and a coordinated network response can be developed. The actions taken enabled effective and positive network outcomes and were represented by coordination among members, collaborative decision-making, inter-organisation communication, centralised coordination for strategy development, provision of support and guidance, development of need-based resource distribution strategies, coordination of supply chain management, coordination between and within different levels (national, regional, local), and rapid relationships and practices development.

The result of the coordinated efforts of actors, resources, and actions is the achievement of network outcomes. A consensus among the studies revealed that the inter-organisational networks achieved hospital and supply chain resilience, fair need-based resource allocation, and value creation for network beneficiaries. Moreover, the paper of Skipworth et al. (2023) highlighted the generation of goodwill for organisations involved in the network. A comprehensive description of the mentioned outcomes can be found in Table 6 in the Appendix.

Despite challenges such as distrust, misaligning values, and risk exposure, the need for a collective response and a shared sense of urgency aided in overcoming these challenges. Overall, these internal factors provide valuable insights into resource orchestration and inter-organisational resilience building for future crises.

4.2.3 Conceptual framework

A conceptual framework was developed based on the identified themes, and it is presented in Figure 7. The framework was constructed by mapping the external and internal factors influencing inter-organisational networks and the relationships among these themes. Three versions of the framework were iteratively designed and refined, and the final version was selected to serve as a guide for exploring how healthcare inter-organisational networks orchestrate resources, particularly during crises when effective coordination across multiple factors is essential for achieving the network's intended goals, for which it formed initially.

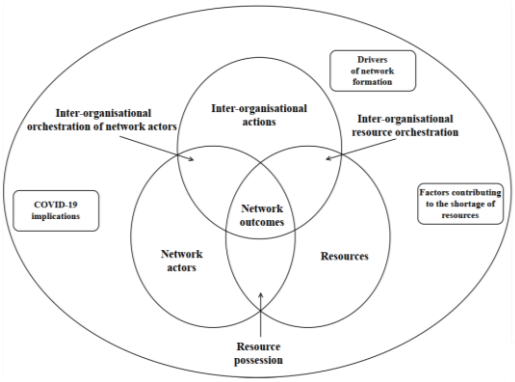

Figure 7: Conceptual framework

The framework connects key concepts and highlights the relationships that arise at their intersections. By mapping these relationships, the conceptual framework structures the inter-organisational network and provides a lens to address the research question, "*How do healthcare inter-organisational networks orchestrate resources during crises?*". Additionally, the proposed conceptual framework demonstrates that the interconnectedness of the internal factors supports effective inter-organisational outcomes in managing crises. The analysis of the included studies revealed that at the intersection of three themes, network actors, resources, and inter-organisational actions, three relationships arise. Two of these emerging relationships are represented by inter-organisational actions for orchestrating resources and inter-organisational orchestration of network actors. These relationships represent two of the developed themes. The last emerging relationship is represented by the possession of resources by network actors. This relationship was discovered during the creation of the framework.

First, at the intersection of inter-organisational actions and resources, the relationship represented by inter-organisational actions for orchestrating resources emerges. These actions span organisational boundaries. Furthermore, these activities lead to the development of capabilities. According to Sirmon et al. (2007), these capabilities are created through bundling actions such as stabilising, enriching, and pioneering. Thus, in the present paper, capabilities are seen as emerging through the

bundling actions taken by the inter-organisational network and its members. The developed capabilities are represented by human, material, organisational, informational, financial, and supply chain information integration capabilities. These capabilities predominantly include the pooling, allocation, reallocation, distribution, and redistribution of resources. Mainly, the coordination of inter-organisational actions creates capabilities that enable rapid adaptation to crises-induced resource disruptions. Additionally, these capabilities ensure the alignment of strategies for managing resources in the network.

Second, the intersection of inter-organisational actions and network members results in the inter-organisational orchestration of actors. These actions represent the mobilisation and coordination of actors to work together towards a common goal. Only through shared governance mechanisms, joint planning, and synchronised responses, these inter-organisational collaborations can encourage mutual responsiveness. The synergy among actors reduces inefficiencies and facilitates decision-making.

Finally, at the intersection of resources and network actors, the possession of resources by actors occurs, indicating which actors hold or control certain resources. However, mere possession does not guarantee effective crisis response, as value co-creation depends on combining various resources of multiple actors (Jaakkola & Hakanen, 2013). Thus, the lack of action by actors cannot lead to a competitive advantage or performance. This aligns with Kraaijenbrink et al. (2010), who argue that the possession of resources is not enough to achieve competitive advantage.

When all three emerging relationships intersect, effective inter-organisational network outcomes can be achieved. Thus, the conceptual framework highlights that, alone, neither of the developed themes can create positive network outcomes. Only through their interactions, the inter-organisational network can produce a mobilised response to a healthcare crisis. The proposed conceptual framework reflects similar conclusions to those drawn by Chadwick et al. (2015), who state that the combination of resources, capabilities, and managerial acumen results in superior performance, and D'Oria et al. (2021), who emphasise the interdependence of resource possession and resource orchestration actions

The framework further aligns with Sirmon et al. (2011), who propose that competitive advantage stems from structuring, bundling, and leveraging resources. In healthcare, this advantage translates to operational performance and timely patient care through structuring actions such as purchasing resources through a central entity (Chen et al., 2021; Dagenais et al., 2023; Sadeghkhani et al., 2025; Tip et al., 2022), producing resources internally in the network (Skipworth et al., 2023; Tip et al., 2022), and divesting excess resources through reallocation (Dagenais et al., 2023; Fattahi et al., 2023; Li et al., 2021; Vatandoost et al., 2023). The bundling actions used were represented by improving existing capabilities, such as the organisational capability through the integration of external supply chain members (Betto & Garengo, 2023; De Luca et al., 2025; Skipworth et al., 2023), extending capabilities such as the informational capability by sharing knowledge in the inter-organisational network (Betto & Garengo, 2023; De Luca et al., 2025; English et al., 2024; Mwije, 2024), and creating new capabilities to address the crisis context. Moreover, the inter-organisational networks employed leveraging actions through mobilising, coordinating, and deploying capabilities, resources, and members to mitigate the crisis. Considering all these points, the framework illustrates that positive network outcomes emerge only through the interaction of actors, resources, and orchestration actions, which will be further discussed in the following section.

5. DISCUSSION

This synthesis literature review indicates that the healthcare inter-organisational actors, actions, and resources are pivotal in managing crises. These elements shape how resources are orchestrated and influence the outcomes of inter-organisational healthcare networks. Moreover, this paper contributes to the resource management literature by clarifying how resources are orchestrated by inter-organisational healthcare networks during crises and offering a visualisation tool that extends the prior knowledge of inter-organisational networks and resource orchestration within them.

This paper assessed specifically the COVID-19 pandemic, which was completely different from other crises provoked by natural disasters or viruses, that are usually localised in a bounded geographical area (Ivanov, 2020). As demonstrated in this paper, proper and effective resource orchestration cannot be done solely by one country or organisation. Only through coordinated, cross-organisational effort, resources can be effectively allocated, the healthcare crisis can be better managed and mitigated.

The synthesis literature review revealed patterns across studies and the relationships emerging from these patterns, which supported the development of the conceptual framework that illustrates how healthcare inter-organisational networks orchestrate resources, particularly during crises. The findings and conceptual framework reinforce the statements made by Sirmon et al. (2007), emphasising the importance of resource orchestration actions at the network-level through structuring, bundling, and leveraging.

The results of this paper suggest that the structuring actions align with the inter-organisational resource orchestration actions such as pooling, allocation, reallocation, distribution, and redistribution of resources. These require network members to make resources accessible at the network-level, through resource possession. Furthermore, this paper emphasises the role of inter-organisational actions for resource orchestration, which play a critical role in the bundling actions used to develop capabilities. Finally, the inter-organisational actions for management of network actors are crucial for leveraging resources and capabilities in the network to produce positive network outcomes.

Specifically, the structuring phase proposed by Sirmon et al. (2007) includes acquiring, accumulating, and divesting actions. The current synthesis literature review revealed various inter-organisational resource orchestration actions that align with the mentioned structuring actions, such as the pooling of resources from various network members, centralised procurement, inter-organisational collaboration of production, etc. Moreover, these actions cannot be taken without network members making their resources available at the network-level.

The bundling actions include the stabilising, enriching, and pioneering sub-processes (Sirmon et al., 2007). In line with the bundling actions are the inter-organisational actions taken to manage and transform resources into capabilities, such as coordinated effort for allocation of supplies, distribution and redistribution of resources, the ability to surge additional resources, etc.

This paper demonstrated that resources were effectively bundled across the organisational boundaries, aligning with the ROT (Sirmon et al., 2007). Different types of resources were bundled into capabilities, enabling value creation at the network-level. However, as the bundling process is shaped by contextual factors such as environmental uncertainty (Sirmon et al., 2007), future

research can investigate the right combination of bundling approaches during crises. Moreover, future research could explore the structuring actions taken at the network-level to support effective bundling actions during crises.

According to Sirmon et al. (2007), the network's capabilities and resources are leveraged through mobilising, coordinating, and deploying actions to create value for both customers and owners. This synthesis literature review identified inter-organisational actions for managing network actors, such as collaborative decision-making, centralised coordination to develop strategies, coordination among members, etc., to be in line with the findings of (Sirmon et al., 2007). Furthermore, this research presented that networks created value for their beneficiaries and for their actors. Additionally, as stated by Sirmon et al. (2007), environmental uncertainty provoked by the COVID-19 in this context, forces companies to respond to the changes. Therefore, new inter-organisational healthcare networks are formed to mitigate the crisis and the challenges it created.

The framework also supports the insights proposed by the ARA model by Hakansson and Johanson (1992) and reinforce that changes in one area can triggers change in networks. During the COVID-19 pandemic, supply chain issues triggered necessary transformations in the existing healthcare networks, leading to new networks emerging or the evolution of existing ones into inter-organisational networks that can provide heterogeneous resources and coordinated responses.

Together, the ARA model and ROT provide an integrated perspective that shows how inter-organisational networks actively manage and adapt their resources to reach network performance. Considering all the findings and the provided conceptual framework, the approach taken during COVID-19 was similar to the ones taken by healthcare networks during other types of crises. For example, just as the inter-organisational networks formed in response to the COVID-19 pandemic, the inter-organisational networks that emerged due to Hurricane Katarina aided in pooling resources, resolving task interdependencies, and leveraging complementary capabilities through cross-sector collaborations (Butts et al., 2012). However, compared to the networks formed in response to Hurricane Katarina, where several organisations did "emerge as central actors in the response process" and played significant coordinating or bridging roles (Butts et al., 2012), the inter-organisational networks that formed during the COVID-19 pandemic, usually were coordinated by a central entity represented by the government in most cases.

Finally, the findings of the current study are consistent with those of Sirmon et al. (2007), who found that the synchronisation of each resource orchestration action is needed to create value. This is further enhanced through the conceptual framework which presents that effective network outcomes cannot be achieved without the synchronisation of the three concepts and the relationships that result at their intersection. Moreover, this study aligns with prior research that highlighted three important insights: first, that resources alone are not enough to achieve performance (Kraaijenbrink et al., 2010); second, that networks form to respond to crises (Tatham & Kovács, 2010); and third, that collaborations help build resilience (Betto & Garengo, 2023). By integrating these insights and applying them to the unique context of the COVID-19 pandemic, the framework extends previous literature by detailing how inter-organisational actions translate into capabilities that further contribute to resilience and timely responses to health crises. Moreover, by demonstrating that neither of the three elements can solely result in positive outcomes at the network-level, the framework offers a clear understanding of the necessary factors for achieving positive outcomes. This conclusion aligns with Chadwick et al. (2015), who emphasise that superior outcomes emerge when resources, capabilities, and managerial acumen are combined, and with Jaakkola and Hakanen (2013) and D'Oria et al. (2021), who state that value co-creation depends on the combination and orchestration of diverse resources by multiple actors.

The focus of this paper was to understand resource orchestration within healthcare networks during crises through the lenses of the supply chain and procurement practices. The synthesis highlights the importance of inter-organisational supply chain practices in mitigating the challenges posed by the COVID-19 crisis. The results contribute to the existing knowledge of resource management within inter-organisational networks, while the conceptual framework provides a pathway from action to impact and a new, structured approach that can be taken by healthcare networks during crises. The conceptual framework situates resource orchestration actions in the dynamic context of healthcare during crises. Therefore, the present study proposes a new context in which orchestration actions can be researched.

These findings present different courses for actions for supply chain and procurement specialists in healthcare networks. Moreover, they involve implications for theory. In the following sub-sections, these will be presented.

5.1 Practical implications

From a practical standpoint, this paper offers insights for supply chain and procurement specialists operating in the healthcare industry during crises, who seek to leverage the conceptual framework for achieving better resource allocation and, thus, better outcomes for their organisation, network, and society.

The conceptual framework emphasises the interconnectedness of the dimensions that shape effective resource allocation and governance at the network-level. Supply chain and procurement specialists can leverage the framework to visualise and identify which relationships and processes need reinforcement during a crisis. Specifically, by recognising the relationships emerging at the intersection of the presented themes, practitioners can prioritise the areas for improvement, strengthen external communication, clarify roles and responsibilities, and set up protocols for resource planning.

This study suggests that by understanding that competitive purchasing reactions can worsen shortages for all network members, practitioners can actively develop or improve the collaborative purchasing structure. This structure achieves better results for the whole network, its members, and beneficiaries. Therefore, through the participation in an inter-organisational network designed to mitigate healthcare crises, organisations and practitioners can optimise resource orchestration and secure resources, which are achieved through engagement in interactions and collaborations. These networks usually involve a central procurement and distribution entity for effective purchasing and distribution of resources, making accurate inter-organisation information sharing crucial. Purchasing practitioners can contribute by sharing accurate and timely information regarding stock, patient inflow, and forecasted usage of resources with network members and the central coordinating entity. Practitioners and their organisations can benefit from the coordination of actions and resources during health crises due to the external information sharing. Moreover, inter-organisational relationships are built through the process of information sharing.

Another important practical implication is that during health crises, practitioners should move towards a rapid relationship development approach to enable quick responses. This involves developing relationships based on trust and shortening the supplier selection process. However, practitioners should be

aware of the potential threats coming from this approach. Even if network members share a sense of urgency, there is no assurance that some organisations will not seek their own benefit and retain information or resources for themselves. Thus, specialists have a role in identifying the wicked problems related to rapid relationship development. Additionally, they play an important role in promoting collaboration within organisations.

Finally, practices that promote inter-organisational collaboration and coordination can enhance the flow, allocation, and distribution of resources, contributing to effective network results. By acknowledging the interconnectedness of resources, network actors, and inter-organisational actions, practitioners can coordinate their organisational efforts with the ones of other network actors to create value for themselves and their beneficiaries. This can be done through joint planning, cooperative strategy development, transparency, and mutual accountability. Emerging inter-organisational networks establish collaborative agreements such as resource-sharing protocols and joint procurement that facilitate rapid responses. By engaging in and promoting these practices, specialists can collectively strengthen the network, thereby delivering sustained value.

The proposed conceptual framework can be used as a support tool for orchestrating resources in healthcare inter-organisational networks. It stresses active engagement in collaborative inter-organisational networks and practices to strengthen supply chain resilience and responsiveness during health crises.

5.2 Theoretical implications

This paper demonstrates two main implications for theory. The first implication is related to supporting the applicability of resource orchestration actions (Sirmon et al., 2007) in the healthcare inter-organisational network context. The second implication is related to the potential of the conceptual framework for future research on inter-organisational networks.

First, the study demonstrated the applicability of resource orchestration actions in the context of healthcare inter-organisational networks. Section 5 presented that, the same processes proposed by Sirmon et al. (2007) in orchestrating resources at the organisational-level, can be extended to the network-level. Consequently, contributions are made to the theory by extending and applying ROT actions to the context of healthcare networks. Moreover, the study by Skipworth et al. (2023) also supports the applicability of ROT actions at the network-level. However, this synthesis literature review further proposes a conceptual framework that posits that in the absence of synchronisation among the resources, inter-organisational actions, and actors, the ROT actions cannot happen.

Secondly, the applicability of the proposed conceptual framework in future research has the potential of serving as a support tool or lens through which future research can assess healthcare inter-organisational networks under crisis conditions and the elements contributing to effective network outcomes. This framework offers a structured approach that considers the interconnectedness of resources, networks, and inter-organisational actions. Therefore, the framework can be used as an extension for investigating how healthcare networks are formed and evolve during crises. Moreover, it has the potential to investigate how these networks respond to resource disruptions. This conceptual framework provides a basis for studying the management of inter-organisational networks and resource orchestration in the healthcare context. Finally, this conceptual framework has the potential to be used to compare different types of inter-organisational networks or how inter-organisational networks react to different types of crises.

6. LIMITATIONS AND FUTURE WORKS

While the systematic literature review provided valuable insights into the resource management literature, it is not without limitations. Acknowledging these limitations can open opportunities for further investigation.

One of the limitations of this synthesis literature review is represented by the relatively small number of papers included in the review. This might be due to the current study including articles with a supply chain management focus. Therefore, articles from computer science and information systems were excluded. Moreover, this limitation can also be explained by the fact that the COVID-19 pandemic represented a totally different crisis compared to other types of crises. Future works can also extend the research to include these fields. Additionally, future research can explore and compare resource orchestration by healthcare networks during different types of crises.

A potential limitation of this study is represented by the exclusion of grey literature, such as organisational reports, due to them not presenting a methodology of how the research was conducted. These publications might have provided valuable practices and approaches taken during a health crisis. Future works could identify and include relevant grey literature in their literature reviews.

Another limitation of this research is represented by the time constraints. The systematic literature review was realised over the period of ten weeks, which is considered relatively short for an extensive literature review. This might have constrained the exploration in greater detail.

Finally, further work needs to be done to test and evaluate the applicability of the conceptual framework. Additionally, future studies could assess its effectiveness in supporting inter-organisational network decision-making.

7. CONCLUSION

This literature review, aimed to explore, synthesise, and establish a foundation based on insights from healthcare inter-organisational networks during the COVID-19 crisis. Through the critical evaluation of the literature, this paper makes significant contributions to the resource management literature by developing a conceptual framework for a holistic understanding of the current practices in the field. The framework includes three elements: resources, network actors, and inter-organisational actions. From these elements, three relationships emerge: resource possession, inter-organisational actions for orchestrating resources, and inter-organisational orchestration actions. At the intersection of these relationships, network outcomes are achieved.

Findings reveal that the COVID-19 context fostered the emergence of healthcare networks, thereby facilitating inter-organizational collaboration and coordination to mitigate the challenges associated with the pandemic. To tackle resource scarcity, different inter-organisational actions aided their orchestration. The main goal of these networks was to develop a need-based approach to allocate and distribute resources. Increased collaboration and mobilisation across non-traditional and traditional organisations tasked with dealing with crises, emerged due to the shared sense of urgency.

This review advances the understanding of resource orchestration during crises and contributes to the resource management literature. It provides a clearer roadmap for addressing inter-organisational networks, offers a clearer foundation for further investigations, and provides practical insights for purchasing and supply chain management specialists.

APPENDIX

Appendix 1: Search strings

Table 2: Search strings

Scopus	Web of Science	PubMed
TITLE-ABS-KEY(“COVID-19” OR covid OR coronavirus OR "coronavirus disease 2019" OR "SARS-CoV-2" OR "COVID-19 pandemic" OR "public health emergency") AND TITLE-ABS-KEY(resource* W/0 (allocation* OR management OR orchestration OR coordination OR mobilization)) AND TITLE-ABS-KEY(healthcare OR health OR (health W/0 (system* OR care))) AND TITLE-ABS-KEY((inter-organizational W/0 network*) OR ((healthcare OR health) W/0 network*) OR network*)	TS=(“COVID-19” OR covid OR coronavirus OR "coronavirus disease 2019" OR "SARS-CoV-2" OR "COVID-19 pandemic" OR "public health emergency") AND TS=(resource$ NEAR/0 (allocation$ OR management OR orchestration OR coordination OR mobilization)) AND TS=(healthcare OR health OR (health NEAR/0 (system$ OR care))) AND TS=((inter-organizational NEAR/0 network$) OR ((healthcare OR health) NEAR/0 network$) OR network$)	("COVID-19"[Mesh] OR "SARS-CoV-2"[Mesh] OR “COVID-19”[tiab] OR “covid”[tiab] OR “coronavirus”[tiab] OR "coronavirus disease 2019"[tiab] OR "SARS-CoV-2"[tiab] OR "COVID-19 pandemic"[tiab] OR "public health emergency"[tiab]) AND ("Health Resources"[Mesh] OR “resource*”[tiab]) AND ("Resource Allocation"[Mesh] OR "Health Care Rationing"[Mesh] OR "Resource-Limited Settings"[Mesh] OR “resource allocation”[tiab] OR “resource management”[tiab] OR “resource orchestration”[tiab] OR “resource coordination”[tiab] OR “resource mobilization”[tiab]) AND ("Community Networks"[Mesh] OR "Group Structure"[Mesh] OR "Social Network Analysis"[Mesh] OR “network*”[tiab] OR “healthcare network*”[tiab] OR "inter-organizational network*"[tiab] OR "interorganizational network*"[tiab] OR "health care network*"[tiab])

Appendix 2: Articles included in the SLR

Table 3: Articles included in the SLR

Authors	Journal	Applied methodology	Research type	Main objectives	Key findings
Betto and Garengo (2023)	International Journal of Production Economics	Empirical - Interviews	Qualitative	- How supply chain resilience (SCRES) is built during pandemics in healthcare.	- Dynamic capabilities emerge to sustain the delivery of healthcare. - Third-order capability: resilience. - A circular pathway was found for developing SCRES to face uncertain events.
Chen et al. (2021)	Insurance: Mathematics and Economics	Empirical - Epidemic modelling and applying classic concepts from risk management and insurance literature	Quantitative	- Provide a framework that allows multiple areas to optimize stockpiling and resources allocation at various pandemic stages.	- Introduced new strategies for optimal stockpiling and allocation that balance spatio-temporal competition for scarce medical supplies during a pandemic.
Dagenais et al. (2023)	Health Systems & Reform	Empirical – Interviews and workshops	Qualitative	- Present a comparative analysis of the lesson learned regarding hospital responses during the pandemic.	- Highlights lessons across four common themes: infrastructure reorganization, human resources management, prevention and control of infection risk, and logistics and supply.
De Luca et al. (2025)	Technological Forecasting and Social Change	Empirical - Online survey from 130 Italian hospitals	Quantitative	- Explain how key resources, such as digital technologies and staff skills, along with the capability of supply chain information integration	- Digital technologies have a direct positive impact on hospital resilience. - Staff skills are positively linked to both internal and

				(SCII), influence hospital resilience. - Understand the role that resources play in building capabilities for achieving resilience, framed within the RBV theory.	external information integration. - Expertise and relational attitude of hospital staff support integration within hospitals and with external stakeholders. - External information integration plays a central role in enhancing hospital resilience.
English et al. (2024)	BMJ Global Health	Theoretical - Scoping review	Qualitative	- To identify how operational readiness (OPR) has been conceptualised and defined in the context of public health emergencies. - To elicit critical elements of "OPR" in the context of key global policy frameworks	- OPR actions were identified that were initiated in anticipation of an imminent threat. - OPR is in an early adoption stage.
Fattahi et al. (2023)	European Journal of Operational Research	Empirical - A multi-stage stochastic program (MSSP)	Quantitative	- Aims to mitigate shortages due to increased demand for limited healthcare resources during a pandemic.	- To address capacity shortages, limited resources like ventilators can be shared. - Transferring patients is an efficient strategy to reduce the total required capacity in hospitals.
Li et al. (2021)	Scientific Reports	Empirical - A mathematical model	Quantitative	- Aims to "analyse the effects of the interaction between supply chain disruption and infectious disease dynamics using coupled production and disease networks built on global data."	- Implementing active network control strategies enables time-sensitive strategies, highlighting the role of agility in prediction, lean resource management, and collaboration to manage the pandemic and support economic recovery. - Pandemics can be controlled through the collaboration across different industries.
Mwije (2024)	Risk Hazards & Crisis in Public Policy	Empirical - Case study design	Quantitative	- Investigate how Uganda used network governance to manage COVID-19.	- The effectiveness of handling a pandemic relies on the government's capacity to identify threats and adopt collaborative mechanisms. - Essential for responding to the COVID-19 crisis, were trust, agreement, and robust coordination between central and peripheral networks.
Sadeghkhani et al. (2025)	BMC Public Health	Empirical - Semi-structured interviews	Qualitative	- Develop a practical framework aimed at strengthening public health sector resilience in response to pandemics.	- Resilience is influenced by the following factors: infrastructure and supply chain management, financial management, human resource management, and crisis management.
Santini (2021)	Omega-International Journal of Management Science	Empirical - An Integer Programming model	Quantitative	- Support decision-makers to maximize the number of conducted test despite the limited reagent supply and logistical challenges.	- Testing capacity can be increased through inter-regional collaboration and steadier supply of reagent.

Skipworth et al. (2023)	International Journal of Operations & Production Management	Empirical - A quantile regression technique	Quantitative	- Investigates how networks of organisations pool their resources and expertise to manufacture and distribute products that are outside of their traditional market, as a response to the COVID-19 pandemic.	- Extending resource orchestration to a network level. - Identify tactics for networks actors to accelerate resource orchestration cycle time. - When the crisis eases, network actors are not willing to continue their involvement in the orchestration process due to the risk exposure.
Tip et al. (2022)	Journal of Public Procurement	Empirical - Semi-structured interviews with 13 hospital purchasers at large hospitals	Qualitative	- Aims to evaluate the procurement strategies employed by hospital purchasers during COVID-19, examine the effects of FMR on these strategies, and determine the effectiveness of purchasing portfolio categorization in the pandemic context.	- Scarcity forces purchasers to treat products as (temporary) bottleneck items at the hospital level. - The strategies employed align with the behaviours predicted by the Kraljic's matrix. - Purchasers and governments act as gatekeepers in managing FMR, reducing the potentially damaging competition both among and within hospitals.
Vatandoost et al. (2023)	BMC Public Health	Empirical - Semi-structured interviews	Qualitative	- Aims to address resource wastage during COVID-19 and identify its causes.	- To reduce costs and resource wastage, effective preparation and planning are needed, as well as reasonable decision-making.

Appendix 3: Journals

Table 4: Journals of the included articles

Journal	**Field (AJG)**	**Journal ranking (AJG 2024)**	**Number of articles**	**Percentages**
International Journal of Production Economics	OPS&TECH	3	1	7.69%
Insurance Mathematics & Economics	FINANCE	3	1	7.69%
Health Systems & Reform	-	-	1	7.69%
Technological Forecasting and Social Change	INNOV	3	1	7.69%
BMJ Global Health	-	-	1	7.69%
European Journal of Operational Research	OR&MANSCI	4	1	7.69%
Scientific Reports	-	-	1	7.69%
Risk Hazards & Crisis in Public Policy	-	-	1	7.69%
BMC Public Health	-	-	2	15.38%
Omega-International Journal of Management Science	OR&MANSCI	3	1	7.69%
International Journal of Operations & Production Management	OR&MANSCI	1	1	7.69%
Journal of Public Procurement	OPS&TECH	1	1	7.69%

Appendix 4: Theories, frameworks, and models

Table 5: Theories, frameworks, and models

Authors	Theories/models/frameworks	Category
Betto and Garengo (2023)	- Dynamic capabilities - Supply chain resilience	- Resource management and strategic decision-making - Supply chain and risk management
Chen et al. (2021)	- Insurance and risk management literature: Insurance applications of epidemic models and Capital allocation	- Supply chain and risk management
De Luca et al. (2025)	- RBV - Hospital resilience	- Resource management and strategic decision-making - Supply chain and risk management
Dagenais et al. (2023)	- Does not present a theoretical background or a theory/model/framework on which the paper is based	- N/A
English et al. (2024)	- Does not present a theoretical background or a theory/model/framework on which the paper is based	- N/A
Fattahi et al. (2023)	- Resource allocation during health crises - A multi-stage stochastic programming approach	- Resource management and strategic decision-making - Optimisation models
Li et al. (2021)	- Does not present a theoretical background or a theory/model/framework on which the paper is based	- N/A
Mwije (2024)	- Network governance theory	- Resource management and strategic decision-making
Sadeghkhani et al. (2025)	- Does not present a theoretical background or a theory/model/framework on which the paper is based	- N/A
Santini (2021)	- Does not present a theoretical background or a theory/model/framework on which the paper is based	- N/A
Skipworth et al. (2023)	- ROT	- Resource management and strategic decision-making
Tip et al. (2022)	- Kraljic matrix - The factor market rivalry (FMR) framework	- Resource management and strategic decision-making
Vatandoost et al. (2023)	- Does not present a theoretical background or a theory/model/framework on which the paper is based	- N/A

Appendix 5: Development of themes

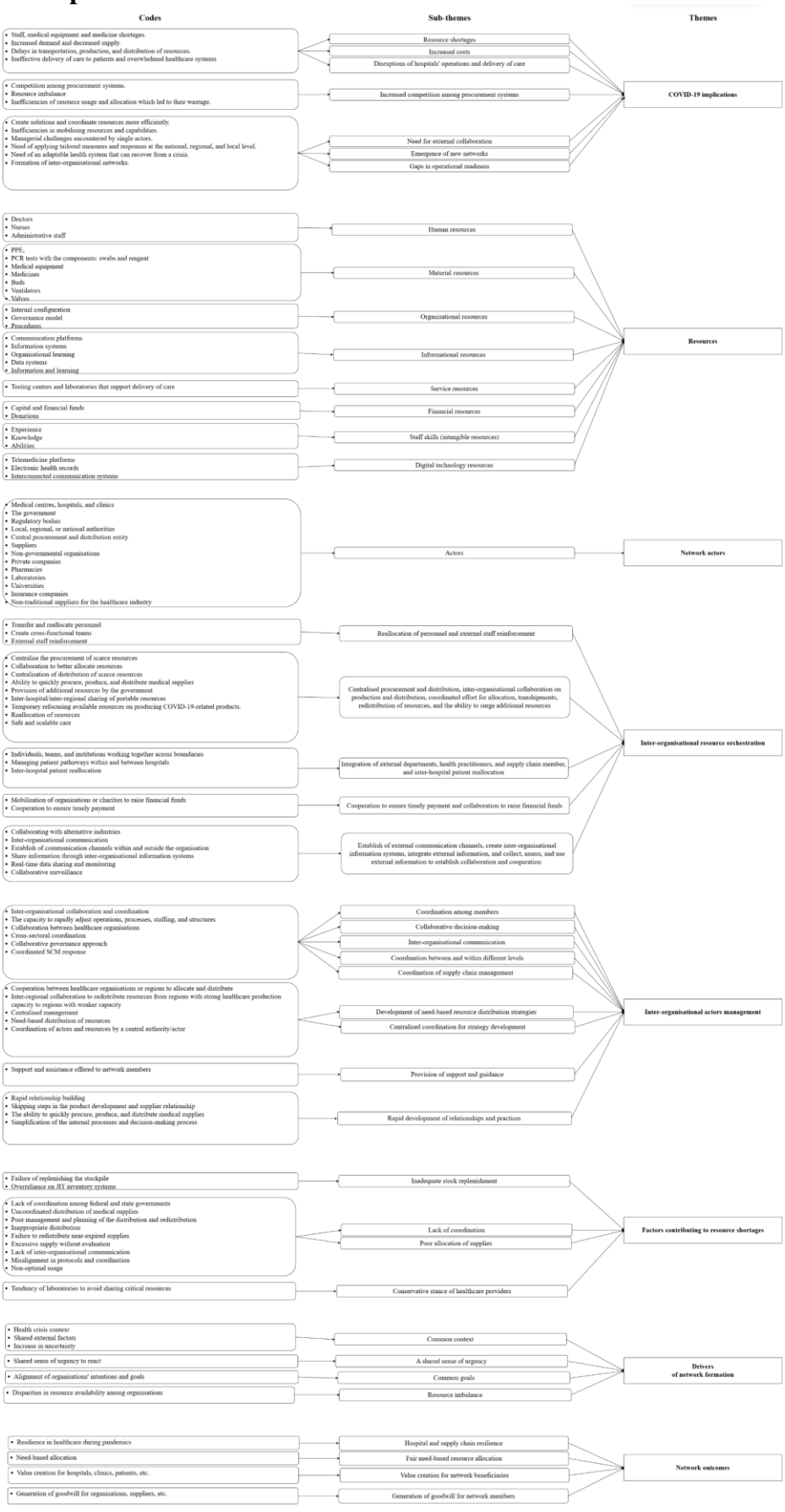

Figure 5: Development of themes

Appendix 6: Definitions of sub-themes

Table 6: Themes, sub-themes, and definitions

Theme	Sub-theme	Definition
COVID-19 implications	Disruption of hospital's operations	Refers to how hospital operations were disrupted during the COVID-19 pandemic.
	Resource shortages	Refers to the scarcity of resources determined by the increased demand and decreased supply.
	Increased competition over resources	Refers to the tensions that occurred among the procurement systems due to the scarcity of resources.
	Increased costs	Refers to the increased expenses experienced by hospitals during COVID-19 pandemic due to the scarcity of qualified medical and nursing staff.
	Need for external collaboration	Refers to the collaboration during the pandemic at the national, regional and local levels, with local authorities, central warehouses, pharmacies, healthcare organisations, to create solutions and coordinate resources.
	Disrupted delivery of care	Refers to the challenges imposed by the high volume of COVID-19 cases and scarcity of resources on healthcare systems, that lead to ineffective delivery of care to patients and overwhelmed healthcare systems worldwide.
	Need for differentiated responses at different levels	Refers to the need of applying tailored measures and responses at the national, regional, and local level during the pandemic, as different contextual challenges.
	Emergence of new networks	Refers to the formation of inter-organisational networks that collaborated to develop solutions and respond to unmet needs during the COVID-19 pandemic.
Resources	Human	Refers to the human resources such as human staff, which are considered a strategic resource during a crisis.
	Material/medical	Refers to the material resources such as PPE, swabs, reagent, medical equipment, medicines, beds, ventilators, PCR tests, valves, etc.
	Organisational	Refers to organisational intangible resources such as the internal configuration, governance model, and procedures.
	Informational	Refers to the resources such as communication platforms, organisational learning, data systems, and information.
	Digital technologies	Refers to the digital technologies such as telemedicine platforms, electronic health records, and interconnected communication systems, that enhances hospital resilience, by enabling real-time data sharing, monitoring, data-driven decision making, etc.
	Staff skills	Refers to the staff skills which are intangible resources such as experience, knowledge, abilities that allow individuals to effectively perform their role.
	Service	Refers to the service resources that support the delivery of care such as testing centres and laboratories.
	Financial	Refers to the funds or capital allocated to support activities aimed at mitigating the impacts of the COVID-19 crisis.
Inter-organisational actions for orchestrating resources	Human resource capabilities	Includes inter-organisational actions such as the reallocation of personnel and external staff reinforcement.
	Material resource capabilities	Reflects an organisation's ability to use centralised procurement and distribution, establish inter-organisational collaboration on production and distribution, coordinated effort for allocation, transhipments, redistribution of resources, and the ability to surge additional resources.
	Organisational resource capability	Includes inter-organisational actions such as the integration of external departments, health practitioners, and supply chain members, and inter-hospital patient reallocation.
	Informational resource capability	Includes inter-organisational actions such as the establishment of external communication channels, creation of inter-organisational information systems, integration of external information, and establishment of collaboration and coordination.
	Supply chain information integration capability	The supply chain information integration is a coordination capability, that reflects a hospital's ability to collect, assess, and use external information to establish collaboration and cooperation.

	Financial resource capability	Includes inter-organisational actions such as cooperation to ensure timely payment and collaboration to raise financial funds.
Network actors		Network actors involves the multitude of actors that form the inter-organisational network and mobilise their efforts towards a common goal such as healthcare providers such as medical centres, hospitals, and clinics, the government, regulatory bodies, local, regional, or national authorities, a central procurement entity, suppliers, non-governmental organisations, private companies, pharmacies, laboratories, universities, insurance companies, and non-traditional suppliers for the healthcare industry.
Inter-organisational actions for network actors' management	Coordination among members	Refers to inter-organisational collaboration and coordination to deliver mobilised efforts and enhance the outcomes of the network.
	Collaborative decision-making	Refers to the collaborative approach to decision-making at the network-level to ensure efficient decisions and better outcomes.
	Inter-organisational communication	Refers to the exchange of information to effectively respond to and mitigate the impacts of the COVID-19 crisis.
	Centralised coordination for strategy development	Refers to the process of organizing and directing strategic planning activities through a central authority or coordinating body to ensure consistency and alignment of objectives across all network members.
	Provision of support and guidance	Refers to the support and assistance offered to network members to enhance their capacity and strengthen collaboration.
	Development of need-based resource distribution strategies	Refers to the creation of distribution and allocation strategies based on the needs of the network members.
	Coordination between and within different levels (national/regional/ local)	Refers to the coordination and alignment among national, organisational, planning, and individual level, that can facilitate or hinder the functioning of other levels.
	Coordination of supply chain management	Refers to the oversight and integration of all activities involved in the procurement, storage, transportation, and distribution of resources, for all network members.
	Rapid relationships and practices development	Refers to rapidly building relationships based on trust and shared goals and skipping steps in the product development and supplier relationship, to ensure quick product development.
Factors contributing to resource shortages	Inadequate stock replenishment	Refers to failure of replenishing the stockpile of medical supplies, due to previous pandemics/crises.
	Lack of coordination	Refers to the lack of coordination among federal and state governments to deploy existing resources.
	Poor allocation of supplies	Refers to the uncoordinated distribution of medical supplies, that lead to differences in supply.
	Conservative stance of healthcare providers	Refers to the tendency of healthcare providers to avoid sharing critical resources such as reagents with other labs due to the fear of future shortages or lack of reciprocity.
Network outcomes	Supply chain resilience	The capability of healthcare supply chains to anticipate, respond to, and recover from disruptions while maintaining operational continuity and service delivery.
	Fair, need-based, resource allocation	Refers to the equitable distribution of resources based on the assessment of needs and priorities of the network members.
	Value creation for network beneficiaries	Refers to the fact that the emerging networks created value for the beneficiaries (hospitals, communities, healthcare workers, and patients).
	Goodwill generation for network actors	Refers to the generated goodwill and positive publicity for network actors due to the altruistically conducted network-level resource orchestration.
Drivers of network formation	Common context	Refers to the shared external factors represented by sever increase in uncertainty of supply, demand and labour, and the direct threat to the life of employees and members of the community, that triggered organisations to join together and develop solutions.
	A sense of urgency	Refers to the shared sense of urgency created by the pandemic, that pushed organisations to react quickly to the changing environment.
	Common goals	Refers to the alignment of organisations' intentions around a shared goal or a community-focused purpose.

	Resource imbalance	Refers to the disparities in resource availability among network members, who attempted to address these shortages by linking new suppliers, finding alternative materials, and restructuring the networks to address the imbalances.

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