Universitas Ahmad Dahlan Public Health Conference (UPHEC)
https://seminar.uad.ac.id/index.php/uphec/index
Volume Maret 2025

Hospital Partnership to Strengthen Resilience during Pandemic: A Systematic Review

Siti Khodijah Parinduri [a,b,1,*], Ni Nyoman Dwi Sutrisnawati [c,2], Wahyu Sulistiadi [a,3]

a University of Indonesia, Jl Margonda Raya, Depok 16424, Indonesia
b Universitas Ibn Khaldun Bogor, KH. Sholeh Iskandar 01/10 kedung Badak, Tanah Sareal 16162, Indonesia
c Program Studi Administrasi Rumah Sakit Universitas Bali Internasional, Gg.Jeruk No.9A Tonja, Denpasar 80234, Indonesia)
1 sikho.parinduri@gmail.com *; 2 dwi.sutrisnawati@gmail.com ; 3 wahyus@gmail.ui.ac.id
* corresponding author: sikho.parinduri@gmail.com

ARTICLE INFO

Article history:
Received Sept 21, 2024
Revised Oct 22, 2024
Accepted Oct 23, 2024

Keywords
COVID-19;
Collaboration;
Healthcare Resilience;
Hospital;
Partership;
Resource Sharing

ABSTRACT

Background: The COVID-19 pandemic has exposed significant vulnerabilities in global healthcare systems, emphasizing the need for robust disaster risk reduction (DRR) strategies. Hospital partnerships have emerged as a vital component in enhancing healthcare system resilience during such crises. This systematic review aims to assess the role of hospital partnership in disaster risk reduction during the COVID-19 pandemic, focusing on the strategies employed, their effectiveness, and the challenges encountered in partnership context.
Method: systematic review of English articles was performed on PubMed, Scopus and Proquest, according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist and guidelines. Studies were included if reporting on the hospital partnership in disaster respons during the COVID-19 pandemic. Exclusion criteria included titles with not available full text, not in English, or not related to disaster response partnership.
Results: The study found that diverse partnerships, including public-private collaborations and community-based initiatives, were essential in boosting healthcare capacity during the COVID-19 pandemic. These partnerships facilitated innovation, improved resource allocation, and provided critical support to healthcare workers and patients. Sustaining such collaborations is key to enhancing healthcare resilience and ensuring equitable care in future crises.
Conclusion: The diverse partnerships formed during the COVID-19 pandemic, from public-private collaborations to community-based initiatives, highlighted the vital role of coordinated efforts in enhancing healthcare capacity and supporting patients and providers. Sustaining these types of partnerships will be crucial for strengthening healthcare resilience and ensuring equitable care in future health crises.

1. Introduction

The COVID-19 pandemic has posed an unprecedented challenge to global healthcare systems. As of 8 September 2024, there have been 776,205,140 confirmed COVID-19 cases globally. The World Health Organization (2024) has recorded a total of 7,064,380 deaths related to the virus. Hospitals, as frontline responders, have faced overwhelming pressures, including a surge in patient numbers exceeding capacity, shortages of personal protective equipment (PPE), and healthcare worker fatigue. These conditions have exposed the vulnerabilities of healthcare systems and highlighted the urgent need for strategies to enhance hospital resilience in the face of pandemics or other disasters (1,2).

The pandemic has significantly impacted healthcare systems and hospital management worldwide. The sudden and massive influx of COVID-19 patients strained hospital capacities, forcing healthcare

facilities to rapidly expand their intensive care units, repurpose existing wards, and implement triage protocols that prioritize patients based on the severity of their conditions. The need for stringent infection control measures disrupted normal hospital operations, leading to the postponement of elective surgeries, a decrease in routine medical care, and a shift in focus towards emergency response.

Additionally, hospitals were challenged by severe shortages of essential medical supplies, such as ventilators, PPE, and testing kits. This scarcity not only endangered the lives of healthcare workers but also complicated the provision of care to patients. The pandemic also exposed gaps in supply chain management, highlighting the need for more robust and flexible systems capable of responding to global crises. Specifically, we identify the centrality of human resource constraints (amidst increasing demand), the necessity of collaboration (amidst competition), and a need to reconsider the approach to leadership (utility of humility) (3,4). Dimensions of effective healthcare emergency management: identify capable leaders; assure robust institutional support; design effective, tiered communications systems; embrace the hospital incident command system to delineate roles and responsibilities; actively promote collaboration and team building; appreciate the necessity of training and exercises; and balance structure and flexibility (5).

One strategy that has gained increasing attention is the partnership between hospitals and various external stakeholders, such as government agencies, non-governmental organizations (NGOs), the private sector, and local communities. Such partnerships are believed to strengthen hospital resilience by facilitating the sharing of resources, knowledge, and enhancing the capacity to respond to crises. Notably, we found that non-profit hospitals are more likely to report partnering with all organization types, as compared to for-profit hospitals. To build health system resilience, stakeholders suggested the need to integrate digital care into the information technology ecosystem, develop strategic public-private partnerships for chronic disease management, and give equal attention to the provision of holistic psychosocial and community support for vulnerable non-COVID patients (6). This was consistent with what we anticipated, as well as earlier studies on hospital partnerships for population health. There was a significant increase in the frequency of hospitals reporting partnerships with most organization types from 2015 to 2017. The most significant increases were for partnerships with schools (69.8% to 75.2%, $p<0.001$), public health organizations (75.9% to 79.7%, $p<0.001$), governmental organizations (74.6% to 76.6%; $p=0.007$), and businesses (69.0% to 72.6%; $p=0.003$) (7). The public sector alone cannot fulfill the increasing demand for masks, medical instruments, hospitals, and medicines to the public at large. Hence an equal or adequate backing from private sector industries is mandatory to tackle this alarming situation. Public–Private Partnership (PPP) is an important strategy to deal with emergencies and outbreaks, particularly in developing countries (8).

Partnership in the context of hospitals refers to a collaborative relationship between two or more organizations that work together towards common goals, particularly in disaster preparedness and response. These partnerships can take various forms, including resource sharing, joint training programs, coordinated patient care, and shared research efforts. The concept of hospital partnership is rooted in the idea that no single institution can effectively manage a large-scale crisis alone, and that collaboration is essential for maximizing resources and improving outcomes (9).

However, building and maintaining effective partnerships is not without challenges. Differences in policies, organizational cultures, and communication styles often serve as significant barriers. Additionally, the logistical complexities of coordinating multiple entities, especially under the pressures of a disaster, can hinder the effectiveness of these partnerships. Trust between organizations, clear communication channels, and aligned objectives are critical for overcoming these challenges and ensuring that partnerships are resilient and productive.

According to qualitative research at DR. Sardjito Hospital, the implementation of IPC is still lacking and has not been implemented properly because most health workers do not have the correct perception of the definition of interprofessional collaboration (10). Poor collaboration and ineffective partnerships between hospitals can have severe consequences on crisis management. When hospitals fail to effectively coordinate with each other and with external organizations, it can lead to duplicated efforts, misallocation of resources, delayed responses, and overall inefficiency in crisis management. This lack of coordination can exacerbate the challenges faced during a crisis, resulting in higher mortality rates,

increased burnout among healthcare workers, and greater strain on already overburdened healthcare systems. The absence of a unified approach can also hinder the sharing of critical information, leading to inconsistent patient care and weakened public trust in healthcare institutions.

Despite the recognized importance of hospital partnerships, there is a significant gap in the literature regarding systematic studies that evaluate their role and effectiveness in enhancing hospital resilience during a pandemic. Much of the existing research focuses on isolated case studies or theoretical discussions, without providing a comprehensive analysis of how these partnerships operate in practice across different contexts and what specific factors contribute to their success or failure. This gap in the literature leaves a critical question unanswered: What are the best practices for building and maintaining hospital partnerships that can effectively support crisis management?

This study aims to address this gap by conducting a systematic review of the existing literature to evaluate the role and effectiveness of hospital partnerships in strengthening resilience during the COVID-19 pandemic. By understanding the factors that support and hinder these partnerships, this research seeks to provide practical recommendations for policymakers and healthcare practitioners in preparing for and responding to future crises.

2. Method

Because of the relatively small number of articles tackling health system resilience, we judged that the health care resilience concept is not mature.

Table 1. Research Questions

Population	Hospital/Health Services
Intervention/Exposure	Partnership/Collaboration/engagement/network
Comparison	n/a
Outcome	Resilience

Searching the literature

The search process began on 30 July 2024, using specific keywords and MeSH terms. A systematic review of English-language articles was conducted across PubMed, Scopus, and ProQuest, with additional searches on WHO websites. We are following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist and guidelines. The search process was assisted by a librarian to ensure thoroughness and accuracy at the one of the databases . Studies were included if they reported on hospital partnerships in disaster response during the COVID-19 pandemic. Exclusion criteria applied to articles without full-text availability, non-English articles, or those unrelated to disaster response partnerships. For example, articles focused on patient or personal resilience were excluded. A total of 120 titles were initially screened, with ineligible records removed. Two reviewers independently screened each title, and any disagreements were resolved through discussion with a third reviewer. From the 21 eligible manuscripts, we extracted details including title, author, year, purpose, method, country, region, type of partnership, involved parties, partnership objectives, key initiatives, and challenges.

Table 2. Keyword and MeSH

Group 1 (Participant)	Group 2 (intervention/exposure)	Outcome	Context
MESH: hospitals OR health service kw: hospital* OR Health Service OR Healthcare	MeSH: Public-Private Sector Partnerships OR Intersectoral Collaboration OR Social Participation OR Community Networks OR Partnership* OR Intersectoral Collaboration (proximity 1) OR Intersectoral Cooperation (proximity 1) OR Social	Kw: Strengthen Resilience (proximity 2) OR Support resilience (proximity 4)	MESH: pandemics OR covid-19 **OR** Kw: pandemic OR "COVID 19" OR SARS-CoV-2 OR

	participation (proximity 1) OR social engagement (proximity 1) OR "Community Health Network*" OR "Health Network*" OR "Social Network Analys*	"SARS CoV 2" OR "Coronavirus Disease 2019" OR disaster* OR emergenc* OR crisis

Pubmed (("Hospitals"[MeSH Terms] OR "Health Services"[MeSH Terms] OR ("hospital*"[Title/Abstract] OR "healthcare"[Title/Abstract] OR "health service"[Title/Abstract])) AND ("public private sector partnerships"[MeSH Terms] OR "social participation"[MeSH Terms] OR "Community Networks"[MeSH Terms] OR "Intersectoral Collaboration"[MeSH Terms] OR ("partnership*"[Title/Abstract] OR "Intersectoral Collaboration"[Title/Abstract:~1] OR "Intersectoral Cooperation"[Title/Abstract:~1] OR "social participation"[Title/Abstract:~1] OR "social engagement"[Title/Abstract:~1] OR "health network*"[Title/Abstract] OR "social network analys*"[Title/Abstract])) AND ("Strengthen Resilience"[Title/Abstract:~2] OR "Support resilience"[Title/Abstract:~4]) AND ("covid 19"[MeSH Terms] OR "Pandemics"[MeSH Terms] OR ("pandemic*"[Title/Abstract] OR "covid 19"[Title/Abstract] OR "sars cov 2"[Title/Abstract] OR "sars cov 2"[Title/Abstract] OR "Coronavirus Disease 2019"[Title/Abstract] OR "disaster*"[Title/Abstract] OR "emergenc*"[Title/Abstract] OR "crisis"[Title/Abstract]))) AND (2020:2024[pdat]).

Data analysis

Three researchers (SK, NY, WS) reviewed agreed the full paper that included. Two reviewers screened the titled and abstract, and disagreements were resolved by discussion with the third reviewer. The selection of the quality article by using the international databased that have indexed in Q1-Q4. After agreeing on the manuscripts, the three reviewers used a data extraction form to examine the publications for Countries, Type of Partnership and Collaboration, Objectives, Key Initiatives and Challenges.

Dealing with meaning and measures

The last step after we get the literature we want, is data extraction, then synthesizing various things that we find from the literature we have chosen (synthesis of evidence). The main purpose of data synthesis is to analyze and evaluate various research results from various literatures, and to choose the most appropriate method to integrate the explanation and interpretation of the various findings. The synthesis we do in the form of a narrative.

3. Result

The PRISMA flow diagram outlines the study selection process for the concept analysis review, focusing on hospital partnerships during the COVID-19 pandemic. The search began with 120 records identified from multiple databases, including Scopus (56 records), ProQuest (40 records), PubMed (13 records), and an additional 11 records from handsearching. The handsearching was conducted after the researcher realized the need for additional relevant information not captured through the database searches. Notably, no duplicates were found across the three databases.

In the screening phase, the titles of the 120 records were evaluated, resulting in the exclusion of 71 studies that were not relevant. This left 49 records for further screening, where the abstracts were assessed. Out of these, 19 records were excluded due to reasons such as not being in English, being the wrong article type, or having a different focus or context that did not align with the study's eligibility criteria.

Eligibility was determined based on the inclusion of studies related specifically to hospital partnerships. A total of 30 full-text articles were assessed, but 9 were excluded because they either lacked full-text access or did not focus on hospital partnerships. As a result, 21 studies met the eligibility criteria and were included in the final review.

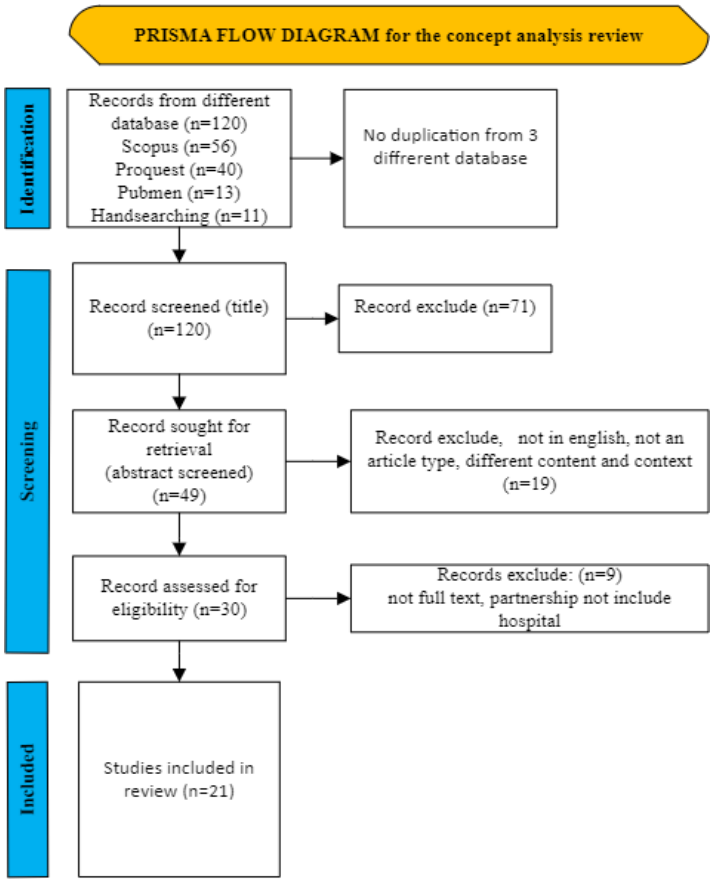

Fig 1. Flowchart of research selection

Certain studies that initially appeared to meet the inclusion criteria were excluded upon closer examination. For example, studies that did not directly involve hospital partnerships or those unavailable in full text were removed. Additionally, studies that did not match the contextual focus of hospital disaster risk reduction were excluded.

The 21 included studies provided diverse insights into the role of hospital partnerships during the COVID-19 pandemic. These studies, originating from various regions and employing different methodologies, helped analyze the strategies used, their effectiveness, and the challenges encountered in disaster risk reduction efforts. The inclusion criteria focused solely on studies related to hospital partnerships, ensuring relevance to the research objective.

Table 3. Characteristics of the study selection

Region	**n**	**%**
Asia	7	33
Europe	4	19
America	10	48
Country		
Bangladesh	1	5
China	2	10
Indonesia	3	14
Italy	1	5
Lebanon	1	5

Switzerland	1	5
UK	2	10
USA	9	43
Others	1	5
Year		
2020	1	5
2021	**7**	33
2023	6	29
2024	**7**	33

The table provides an overview of the regional and country-level distribution of studies related to hospital partnerships in disaster risk reduction during the COVID-19 pandemic. The regions are categorized into Asia, Europe, and America, representing the distribution of studies by continent. Most of the studies (48%) were conducted in America, followed by Asia (33%) and Europe (19%).

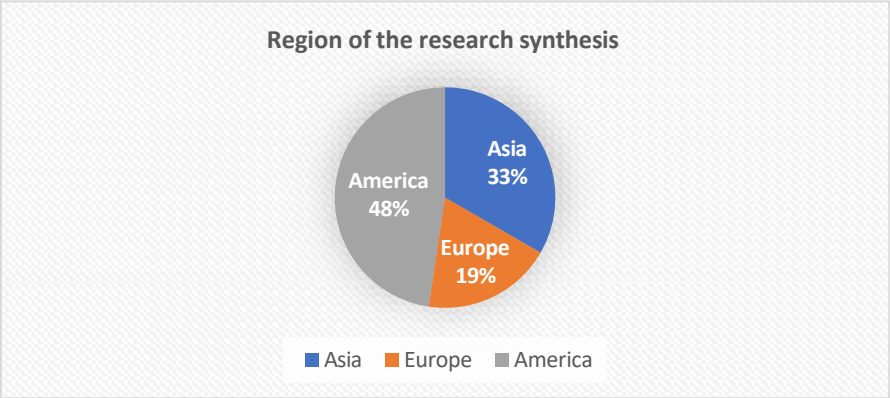

Fig 2. Region of the research selection 2020-2024

At the country level, the United States accounts for the highest number of studies, comprising 43% of the total. This reflects the significant focus on hospital partnerships in the USA during the pandemic. Other notable contributors include Indonesia (14%), China (10%), and the United Kingdom (10%). Several countries, such as Bangladesh, Italy, Lebanon, and Switzerland, each contributed 5% of the studies. The category labelled other accounts for 5% as well, capturing contributions from countries not explicitly listed.

The table presents the distribution of studies published between 2020 and 2024, focusing on hospital partnerships in disaster risk reduction during the COVID-19 pandemic. The highest number of studies were published in both 2021 and 2024, each contributing 33% of the total. This is followed by 2023, accounting for 29% of the studies, while 2020 represents only 5% of the total publications. The limited timeframe of 2020 to 2024 was selected to capture the most relevant and up-to-date research directly related to the pandemic response and the evolving strategies employed by hospital partnerships. The data suggests that most of the research was conducted in the years following the initial outbreak, reflecting the growing interest in evaluating and improving disaster risk reduction strategies as the global response to COVID-19 unfolded.

Parties Involved in Partnerships

a) Government Agencies: Governments were key initiators of many pandemic response partnerships, often forming alliances with the private sector to quickly mobilize resources and coordinate public health efforts. For example, in China, the government partnered with thousands of private companies to produce and distribute essential PPE, ventilators, and other medical supplies. This government-led initiative demonstrated the power of leveraging public authority to engage large-scale private sector participation (8,11–14)

b) Hospitals and Healthcare Providers: Hospitals, especially those in highly affected areas, engaged in both local and international partnerships. These healthcare institutions collaborated closely with community organizations, private medical companies, and academic institutions to expand their capacity, enhance patient care, and share resources during the crisis. Examples include hospitals in the UK that collaborated with universities to develop ICU-specific teams and hospitals in the US partnering with the military for resource allocation (4,14–17)

c) Private Sector Companies: Private companies, particularly those in the technology, logistics, and healthcare sectors, played an instrumental role in providing innovative solutions and scaling operations. AI developers, for example, collaborated with hospitals to create virtual agents that supported patient interactions, reducing the burden on medical staff. In China and Europe, the private sector also facilitated the development of data-sharing platforms to improve hospital coordination (8,18)

d) Academic and Research Institutions: Universities and academic medical centers provided critical research, innovation, and volunteer medical teams. In the US, academic institutions like the University of California, San Francisco (UCSF) partnered with underserved communities, such as the Navajo Nation, to provide healthcare support. These partnerships exemplified the value of combining academic expertise with community outreach to address healthcare disparities (12,14,15,17,19,20)

e) Non-Governmental Organizations (NGOs) and International Organizations: NGOs and international health organizations were key in facilitating cross-border collaborations. In Indonesia, for example, USAID partnered with the Muhammadiyah health network to train healthcare workers and improve COVID-19 case management. This kind of international collaboration ensured that lower-income countries received the support necessary to strengthen their healthcare response during the pandemic (14,21–23).

Types of Partnerships

a. Public-Private Partnerships (PPP):

Public-Private Partnerships (PPP) involve collaboration between government agencies and private sector entities to deliver public services or projects, combining public oversight with private sector expertise and resources (12)

China's Government and Private Sector Collaboration: The Chinese government partnered with more than 3,000 private companies to mass-produce PPE and other critical medical supplies. This partnership allowed for the rapid mobilization of resources to meet the country's urgent healthcare needs, demonstrating how public authority can guide large-scale private participation during a crisis (8,11)

US Public-Private Initiatives: In the US, public-private partnerships focused on coordinating supply chains and resource distribution for hospitals. Technology companies developed digital tools, while medical supply companies ensured the availability of essential healthcare materials. This collaboration increased efficiency in resource allocation, particularly during the early phases of the pandemic when PPE and ventilators were in short supply (11)

b. Multisector and Multidisciplinary Collaborations:

Multisector partnerships involve collaboration across different sectors such as healthcare, government, academia, and private industry. These collaborations focus on addressing complex challenges by leveraging expertise from various fields.

UK Prone Ventilation Team: Hospitals in the UK formed multidisciplinary teams involving clinicians, administrative staff, and academic experts to establish specialized prone ventilation units. This collaboration helped reduce the strain on ICU teams by ensuring that patients with severe COVID-19 respiratory symptoms received timely care.
California Academic Medical Centers and Vulnerable Communities: In the US, academic medical centers like UCSF partnered with communities like the Navajo Nation to provide volunteer medical teams. This partnership not only improved healthcare delivery in

underserved regions but also highlighted the importance of leveraging academic resources and community networks during health crises.

c. Technology and Data-Driven Partnerships:

These partnerships focus on the integration of technology and data to enhance healthcare operations. They often involve collaboration between hospitals, technology companies, and government bodies to develop tools for decision-making, patient management, and resource optimization.

AI and Data Sharing in the US and Europe: Hospitals in the US partnered with AI developers to create virtual agents that supported patient interactions, while in Europe, hospitals collaborated on data-sharing platforms to optimize patient care and improve hospital capacity management. These partnerships allowed for real-time decision-making, better resource distribution, and more efficient healthcare delivery during the pandemic.

d. Cross-Hospital and International Collaborations:

Cross-hospital collaborations involve partnerships between different healthcare institutions, often spanning national borders. These collaborations focus on sharing knowledge, resources, and best practices to improve healthcare outcomes in times of crisis (24–26).

European Hospital Collaboration: During the pandemic, hospitals across Europe formed partnerships to share data and coordinate care. For example, hospitals in Italy and the UK collaborated to share testing capacities and ICU resources, ensuring that patient care remained uninterrupted even during surges (15,16,19).

USAID and Indonesian Hospitals: International collaborations, such as the USAID-Muhammadiyah partnership, provided training to healthcare workers in Indonesia, enhancing their ability to manage COVID-19 cases. These collaborations highlighted the importance of global solidarity and knowledge-sharing in managing pandemics in developing countries (27).

e. Community-Healthcare Partnerships:

These partnerships involve healthcare providers collaborating directly with local communities to provide medical services, education, and resources. They focus on addressing health inequities and delivering care to underserved populations. Navajo Nation and UCSF Partnership: In the US, UCSF partnered with the Navajo Nation to send volunteer healthcare teams to under-resourced hospitals. This partnership addressed disparities in healthcare access and ensured that vulnerable populations received timely medical care during the pandemic (20).

f. Healthcare Training Partnerships:

These partnerships focus on providing healthcare workers with essential training on infection control, patient management, and crisis response. They often involve collaborations between governments, hospitals, and international organizations.

Indonesia's Training Initiatives: In Indonesia, the USAID-funded partnership with Muhammadiyah provided structured training programs to healthcare workers on COVID-19 case management and infection control. This partnership strengthened local hospitals' ability to respond effectively to the pandemic, particularly in rural areas (27).

Benefits of Partnerships

Partnerships during the COVID-19 pandemic offered several key benefits. First, they enabled rapid mobilization of critical resources, such as PPE, ventilators, and testing kits, with governments partnering with private manufacturers to scale production and meet rising demand. Second, partnerships helped expand healthcare capacity, ensuring sufficient staffing and resources during peak periods. For example, in the UK, multidisciplinary teams alleviated ICU strain by establishing dedicated units for severe COVID-19 cases. Third, technology-driven collaborations led to innovations like AI-based tools for patient interaction and data-sharing platforms for hospital coordination, improving both patient care and operational efficiency. Additionally, community-healthcare partnerships were vital in addressing

health inequities, ensuring that vulnerable populations, such as those in the Navajo Nation, had access to timely care. Finally, partnerships between hospitals and community organizations provided mental health support programs for frontline workers, helping to address burnout and stress (11,14,17–20,22,24,27–30).

Lessons Learned from Partnerships:

a) Pre-Existing Networks Enhance Crisis Response: Partnerships that had pre-established relationships before the pandemic were better equipped to respond quickly and efficiently. This was evident in healthcare systems that had strong connections with community organizations and other healthcare institutions (12).
b) Adaptability and Flexibility Are Key: Successful partnerships demonstrated a high degree of flexibility, adapting to evolving challenges like PPE shortages, staff burnout, and logistical issues. The ability to pivot and reallocate resources quickly was crucial in managing the crisis effectively (31).
c) Sustainability of Innovations Post-Crisis: The pandemic accelerated the adoption of new technologies, but sustaining these innovations requires (4,32) ongoing collaboration and investment. Ensuring that AI tools, data-sharing platforms, and other innovations remain integrated into healthcare systems will be essential for long-term improvements.
d) Global Knowledge Sharing is Crucial: International partnerships played a critical role in sharing best practices, particularly for countries with limited healthcare resources. Global collaborations should continue to foster cross-border knowledge sharing to improve preparedness for future pandemics (23).
e) Healthcare Equity Must Be a Priority: Partnerships that focused on vulnerable and underserved communities highlighted the need for equitable healthcare access. Future partnerships should prioritize health equity to ensure that no population is left behind during health crises (8).

The diverse types of partnerships formed during the COVID-19 pandemic demonstrated the power of collaboration in addressing complex global health challenges. From public-private partnerships to community-based initiatives, these collaborations enhanced healthcare capacity, fostered innovation, and provided critical support to both patients and healthcare workers.

4. Discussion

The distribution shows a strong focus on hospital partnerships in America, especially in the United States. The variety of countries involved reflects the global response to the COVID-19 pandemic, though America contributed more to the research on hospital partnerships. The US and UK were the most predominant countries within the global research collaborations (33). The COVID-19 pandemic highlighted the vital role of partnerships across different sectors and geographies in responding to global health crises. Diverse types of collaborations emerged, involving government agencies, healthcare providers, private companies, academic institutions, and non-governmental organizations (NGOs). Each partnership brought unique strengths that, when combined, facilitated the rapid mobilization of resources, innovation in healthcare delivery, and the provision of crucial support to both patients and healthcare workers. (34).

1) Government-Led Initiatives and Public-Private Partnerships

Government agencies often spearheaded many partnerships, leveraging their authority to engage the private sector and streamline resources. For example, in China, the government collaborated with thousands of private companies to mass-produce and distribute personal protective equipment (PPE) and ventilators. This initiative demonstrated how public leadership can drive large-scale private participation, ensuring that critical medical supplies were delivered efficiently. Similarly, in the U.S., technology firms and medical suppliers joined forces with government bodies to coordinate the distribution of essential resources like PPE, which was in short supply during the initial stages of the pandemic. Public private partnership is a term that can be used to describe a broad category of activities and structures involving public and private

sectors, defied by WHO broadly as "wide variety of ventures involving a diversity of arrangements, varying with regard to participant, legal status, governance, management, policy-setting prerogative". PPP involves one core public, non-commercial organization and one private or commercial organization that joins to share efforts and rewards of the collaboration (35). These Public-Private Partnerships (PPPs) allowed for the rapid scaling of operations and optimized resource allocation. The private sector's expertise in logistics, technology, and healthcare manufacturing combined with public oversight ensured that systems could respond to the evolving needs of healthcare providers, especially in high-demand areas like PPE production and distribution.

2) Healthcare and Academic Collaborations

Hospitals and healthcare providers played a frontline role in pandemic response, forming critical partnerships with academic and research institutions. These collaborations expanded the healthcare system's capacity by sharing knowledge, expertise, and resources. For instance, hospitals in the UK partnered with universities to develop specialized intensive care unit (ICU) teams, focusing on prone ventilation units to treat severe COVID-19 patients. These multisector collaborations leveraged academic expertise and healthcare experience to enhance patient care and reduce strain on ICU staff.

In the U.S., academic medical centers like the University of California, San Francisco (UCSF) partnered with underserved communities, such as the Navajo Nation, to deploy volunteer medical teams. This partnership not only provided vital healthcare services to vulnerable populations but also underscored the value of academic resources in addressing healthcare disparities (20).

3) Technology-Driven Solutions

Technology and data-sharing played a crucial role in pandemic response efforts. The integration of technology-driven partnerships allowed for more efficient healthcare operations, particularly in patient management and hospital coordination. For example, AI developers collaborated with hospitals in the U.S. to create virtual agents, assisting in patient interactions and reducing the burden on medical staff. In Europe, hospitals utilized data-sharing platforms to optimize hospital capacity, improving resource distribution and real-time decision-making.

These partnerships between tech companies, hospitals, and government bodies significantly enhanced healthcare delivery by improving response times and streamlining operations. AI-based tools were particularly effective in managing patient flows and interactions, demonstrating the potential for digital innovation in crisis management.

4) Cross-Hospital and International Collaborations

Cross-hospital and international partnerships were essential for knowledge sharing and resource allocation, particularly in regions with overstressed healthcare systems. For example, hospitals in Italy and the UK collaborated to share ICU resources and testing capacities, ensuring that patient care was maintained during surges in COVID-19 cases. These international collaborations emphasized the importance of solidarity across borders, helping nations manage their healthcare responses more effectively.

Additionally, partnerships like USAID's collaboration with Indonesia's Muhammadiyah health network showcased the importance of global health partnerships. Training healthcare workers in lower-income countries was crucial for building local capacity and managing the pandemic, especially in rural areas with limited healthcare infrastructure (27)

5) Community-Based and Healthcare Training Partnerships

Community-healthcare partnerships proved essential in addressing health inequities, particularly in underserved populations. UCSF's partnership with the Navajo Nation is an example of how collaboration between healthcare providers and local communities can close gaps in healthcare access. These partnerships focused on providing not just medical services but also health education and resources, targeting the most vulnerable populations.

Moreover, healthcare training partnerships were key to equipping healthcare workers with the necessary skills to manage the pandemic. For instance, USAID's training initiative in Indonesia helped strengthen the country's healthcare response, particularly in infection control and crisis

management. This partnership ensured that healthcare workers were better prepared to manage the ongoing health crisis, enhancing the overall resilience of the healthcare system.

6) Lessons Learned from Pandemic Partnerships

The COVID-19 pandemic highlighted several key lessons for future crisis management. Pre-existing networks enabled quicker and more effective responses, particularly where healthcare providers and community organizations had prior partnerships. Adaptability and flexibility proved essential, as successful partnerships managed challenges like PPE shortages by reallocating resources. The crisis accelerated the use of innovative technologies such as AI and data-sharing platforms, though sustaining these requires ongoing investment. Global knowledge-sharing facilitated valuable cross-border collaboration, particularly for resource-limited nations. Lastly, the pandemic emphasized the importance of healthcare equity, as partnerships targeting underserved communities highlighted the need for equitable care access during crises.

Strengths and Limitations

A broad keyword introduced variability in the context of the retrieved journals, leading to the need for additional hand-searching to identify more relevant literature. Despite these limitations, the study's strength lies in its comprehensive synthesis of global experiences. By carefully reviewing each selected journal, the research was able to extract detailed insights, particularly regarding specific partnership models, and capture crucial information for a deeper understanding of the subject matter.

5. Conclusion

The diverse partnerships formed during the COVID-19 pandemic demonstrated the power of collaboration in addressing complex global health challenges. From public-private partnerships to community-based initiatives, these collaborations enhanced healthcare capacity, fostered innovation, and provided critical support to both patients and healthcare workers.

Acknowledgment

This research did not receive any grant funding or external donations. The correspondence author, as a recipient of the BPI scholarship, expresses gratitude for the support provided for academic studies and the assistance during the PhD program at Universitas Indonesia.

REFERENCES

1. Sharma SK, Sharma N. Hospital Preparedness and Resilience in Public Health Emergencies at District Hospitals and Community Health Centres. J Health Manag. 2020;22(2):146–56.
2. Mulyasari F, Inoue S, Prashar S, Isayama K, Basu M, Srivastava N, et al. Disaster preparedness: Looking through the lens of hospitals in Japan. International Journal of Disaster Risk Science. 2013;4(2):89–100.
3. Gifford R, Van De Baan F, Westra D, Ruwaard D, Fleuren B. Through the looking glass: Confronting health care management's biggest challenges in the wake of a crisis. Health Care Manage Rev. 2023;48(2):185–96.
4. Ivankovic D, Garel P, Klazinga N, Kringos D. Data-Driven Collaboration between Hospitals and Other Healthcare Organisations in Europe During the COVID-19 Pandemic: An Explanatory Sequential Mixed-Methods Study among Mid-Level Hospital Managers. Int J Integr Care [Internet]. 2023 [cited 2024 Aug 28];23(2). Available from: /pmc/articles/PMC10275210/
5. Atkinson MK, Cagliuso NV, Hick JL, Singer SJ, Bambury EA, Hayirli TC, et al. Moving Forward from COVID-19: Organizational Dimensions of Effective Hospital Emergency Management. Health Secur. 2021;19(5):508–20.
6. Yoon S, Goh H, Chan A, Malhotra R, Visaria A, Matchar D, et al. Spillover Effects of COVID-19 on Essential Chronic Care and Ways to Foster Health System Resilience to Support Vulnerable

Non-COVID Patients: A Multistakeholder Study. J Am Med Dir Assoc [Internet]. 2021;23(1):7–14. Available from: http://dx.doi.org/10.1016/j.jamda.2021.11.004
7. Ellis Hilts K, Gibson PJ, Blackburn J, Yeager VA, Halverson PK, Menachemi N. Institutional factors associated with hospital partnerships for population health: A pooled cross-sectional analysis. Health Care Manage Rev. 2022 Jul 1;47(3):254–62.
8. Abbas HSM, Xu X, Sun C, Gillani S, Raza MAA. Role of Chinese government and Public–Private Partnership in combating COVID-19 in China. Journal of Management and Governance. 2023;27(3):727–48.
9. Gooding K, Bertone MP, Loffreda G, Witter S. How can we strengthen partnership and coordination for health system emergency preparedness and response ? Findings from a synthesis of experience across countries facing shocks. BMC Health Serv Res [Internet]. 2022;1–19. Available from: https://doi.org/10.1186/s12913-022-08859-6
10. Henley T, Gregory-Martin K, Hopkins U, Amaya AB. Exploring Interprofessional Education and Collaboration in the Midst of COVID-19. J Health Hum Serv Adm. 2023;46(3–4):250–66.
11. Davis NR, Doughty CB, Kerr T, Elegores G, Davis KI, Kaziny BD. Rapidly building surge capacity within a pandemic response using simulation-based clinical systems testing. BMJ Simul Technol Enhanc Learn. 2021;7(5):304–10.
12. Yusaf T, Meguerdichian M, Astuto A, Rucker L, Arbo J, Bajaj K. Early lessons learnt using simulation to rapidly deploy a trained observer programme during the COVID-19 pandemic in New York City. BMJ Simul Technol Enhanc Learn. 2021;7(5):441–3.
13. Park S, Hamadi HY, Nguyen AT, Tran V, Haley DR, Zhao M. Examining the Relationship between Hospital-Community Partnerships and COVID-19 Case-Fatality Rates. Popul Health Manag. 2022 Feb 1;25(1):134–40.
14. Sakr CJ, Assaf SA, Fakih L, Dakroub S, Rahme D, Musharrafieh U, et al. Hospitals' Collaborations Strengthen Pandemic Preparedness: Lessons Learnt from COVID-19. Healthcare (Switzerland). 2024 Feb 1;12(3).
15. Christofferson RC, O'Neal HR, Jagneaux T, O'Neal C, Walsh CS, Mayton EH, et al. Reduced turnaround times through multisectoral community collaboration during the first surge of SARS-CoV-2 and associated effect on patient care and hospital operations. PLoS One. 2021;16(10 October).
16. Gorla F, Borojevic A, Gibertoni C, Landi L, Storchi M, Fontana L, et al. The Hospital of Tomorrow Case Study: Multidisciplinarity, Inclusiveness and Holistic Approaches to Foster Innovation in Complex Organizations. Int J Health Policy Manag. 2023;12(1).
17. Wu AW, Connors CA, Norvell M. Adapting RISE: meeting the needs of healthcare workers during the COVID-19 pandemic. Int Rev Psychiatry [Internet]. 2022;33(8):711–7. Available from: http://dx.doi.org/10.1080/09540261.2021.2013783
18. Ivankovic D, Garel P, Klazinga N, Kringos D. Data-Driven Collaboration between Hospitals and Other Healthcare Organisations in Europe During the COVID-19 Pandemic: An Explanatory Sequential Mixed-Methods Study among Mid-Level Hospital Managers. Int J Integr Care. 2023;23(2).
19. Bracegirdle L, Stubbs M, Rahman R, Jackson AIR, Burton-Papp HC, Chambers R, et al. Organisation and delivery of a dedicated multidisciplinary prone ventilation team in the intensive care unit: Strategies and lessons from COVID-19. PLoS One. 2023;18(12 Decembe).
20. Bongiovanni T, Shamasunder S, Brown W, Carpenter CR, Pantell M, Ghali B, et al. Lessons learned from academic medical centers' response to the COVID-19 pandemic in partnership with the Navajo Nation. PLoS One. 2022 Apr 1;17(4 April).
21. Fadaak R, Davies JM, Blaak MJ, Conly J, Haslock J, Kenny A, et al. Rapid conversion of an in-patient hospital unit to accommodate COVID-19: An interdisciplinary human factors, ethnography, and infection prevention and control approach. PLoS One. 2021 Jan 1;16(1 January).
22. Sonke J, Rodríguez L, Valerio-Shewmaker MA. Toward a Culture of Health in the United States: Introducing the HPP Arts in Public Health Supplement. Health Promot Pract [Internet]. 2021;22(1_suppl):5S-7S. Available from: http://dx.doi.org/10.1177/15248399211002512

23. Baughman AW, Hirschberg RE, Lucas LJ, Suarez ED, Stockmann D, Hutton Johnson S, et al. Pandemic Care Through Collaboration: Lessons From a COVID-19 Field Hospital. J Am Med Dir Assoc [Internet]. 2020;21(11):1563–7. Available from: https://www.sciencedirect.com/science/article/pii/S1525861020307465
24. Shahrin L, Parvin I, Sarmin M, Abbassi NA, Ackhter MstM, Alam T, et al. In-person training on COVID-19 case management and infection prevention and control: Evaluation of healthcare professionals in Bangladesh. PLoS One. 2022;17(10 October).
25. Marmo R, Pascale F, Diana L, Sicignano E, Polverino F. Lessons learnt for enhancing hospital resilience to pandemics: A qualitative analysis from Italy. International Journal of Disaster Risk Reduction [Internet]. 2022;81:103265. Available from: https://www.sciencedirect.com/science/article/pii/S2212420922004848
26. Stennett J, Hou R, Traverson L, Ridde V, Zinszer K, Chabrol F. Lessons Learned From the Resilience of Chinese Hospitals to the COVID-19 Pandemic: Scoping Review. JMIRx Med. 2022;3(2):e31272.
27. The United States Partners with Muhammadiyah to Advance COVID-19 Case Management in Hospitals [Internet]. 2021 [cited 2024 Sep 21]. Available from: https://www.usaid.gov/indonesia/press-release/united-states-partners-muhammadiyah-advance-covid-19-case-management-hospitals
28. Daszak P, Keusch GT, Phelan AL, Johnson CK, Osterholm MT. Commentary infectious disease threats: A rebound to resilience. Health Aff. 2021 Feb 1;40(2):204–11.
29. Pigozzi L. Review Research COMMUNITY ENGAGEMENT IN DISASTER PREPAREDNESS DURING THE COVID-19 PANDEMIC: A SYSTEMATIC REVIEW.
30. Kesehatan Pasak Bumi Kalimantan J, Kedokteran Universitas Mulawarman Jurnal Kesehatan Pasak Bumi Kalimantan F, Farah Anisa N, Ardiana A, Endrian Kurniawan D, Asmaningrum N, et al. Implementation of Nurse-Doctor Interprofessional Collaboration During the Covid-19 Pandemic According to Nurses' Perceptions in Hospital [Internet]. Vol. 6, JKPBK. 2023. Available from: http://e-journals.unmul.ac.id/index.php/JKPBK
31. Jordan SR, Connors SC, Mastalerz KA. Frontline healthcare workers' perspectives on interprofessional teamwork during COVID-19. J Interprof Educ Pract. 2022;29.
32. Sakr CJ, Assaf SA, Fakih L, Dakroub S, Rahme D, Musharrafieh U, et al. Hospitals' Collaborations Strengthen Pandemic Preparedness: Lessons Learnt from COVID-19. Healthcare (Switzerland) [Internet]. 2024 Feb 1 [cited 2024 Aug 28];12(3):321. Available from: https://www.mdpi.com/2227-9032/12/3/321/htm
33. Benach J, Cash-Gibson L, Rojas-Gualdrón DF, Padilla-Pozo Á, Fernández-Gracia J, Eguíluz VM. Inequalities in COVID-19 inequalities research: Who had the capacity to respond? PLoS One. 2022 May 1;17(5 May).
34. Noh E, Potthoff S, Begun JW. A taxonomy of hospitals based on partnerships for population health management. Health Care Manage Rev. 2020 Oct 1;45(4):321–31.
35. Strasser S, Stauber C, Shrivastava R, Riley P, O Quin K. Collective insights of public-private partnership impacts and sustainability: A qualitative analysis. PLoS One. 2021 Jul 1;16(7 July).