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Organisation of cross-sector collaboration and its influence on crisis management effectiveness among pharmaceutical supply chain stakeholders during the COVID-19 pandemic

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ABSTRACT

Objectives: To investigate the organisation of cross-sector collaboration and how it influenced crisis management effectiveness among pharmaceutical supply chain stakeholders in Finland during the COVID-19 pandemic.

Study design: Qualitative semi-structured interview study.

Methods: Purposeful selection was used to obtain the study sample consisting of leaders and specialists from the pharmaceutical industry and wholesalers (n = 9), community pharmacy owners (n = 9), hospital pharmacy heads (n = 6), government agency directors and officials (n = 5) and advocacy organisation representatives (n = 2). Inductive content analysis was performed to examine the data from the semi-structured individual (n = 29) and paired (n = 2) interviews in March–May 2021.

Results: A new conceptual model was developed to describe the organisation of collaborative crisis management. Without a predefined crisis management organisation, cross-sector collaboration was organised based on previous collaboration structures, channels and relationships and through the establishment of issue-specific groups by government agencies as per legal mandates. Crisis dynamics and related issues guided the group formation and meeting frequency. Advocacy organisations and government agencies acted in bridging role between stakeholders. Shared knowledge among pharmaceutical supply chain stakeholders enabled anticipation and preparedness during crisis; shared resources fostered maintenance of core functions; and shared problem-solving facilitated cross-sectoral solutions.

Conclusion: This was the first study exploring cross-sector collaboration among pharmaceutical supply chain stakeholders during a crisis. Sharing knowledge, resources and problem-solving increased the crisis management effectiveness. The study presented a new illustration of organising for collaborative crisis management and added knowledge about private-third sector collaboration and issue-specific groups to the cross-sector collaboration and crisis management literature.

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Introduction

Pharmaceutical supply chains around the globe have suffered from demand fluctuations, manufacturing capacity issues and distribution problems due to the coronavirus disease 2019 (COVID-19)

pandemic.¹ Preventing and managing these issues is vital for public health because medicine and vaccine shortages may lead to severe health risks and compromise medical care.² The pandemic has affected all parts of the interdependent supply chain in Finland, forcing government agencies, the pharmaceutical industry, wholesalers, community and hospital pharmacies, and advocacy organisations to respond together to this unexpected crisis.

Although uncertainty and urgency challenge the collaboration, crisis management research highlights the advantages of cross-sector collaboration in complex crises.^{3–7} A common operating

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picture enables informed decision making and action adjustments in accordance with other organisations.^{8,9} Shared resources, skills development and reflective lesson learning foster future crisis preparedness.^{4,5} However, cross-sector collaboration reduces crisis management effectiveness if bureaucracy leads to delays or politically biased aid distribution.¹⁰

Collaborative crisis management usually involves a centralised governance structure and the self-organisation of interdependent organisations.⁶ The widely accepted command-and-control model provides a standardised approach to emergencies.^{11,12} However, predefined hierarchies and top-down coordination can hinder the management of complex crises, which require improvised, adaptive and networked responses.^{6,13,14} Without a predefined crisis management governance structure, interorganisational collaboration tends to self-organise to epistemic or ad hoc overlapping networks.^{6,15,16}

According to recent research, interdependent tasks increase the effectiveness of multi-agency response;¹⁷ however, consensus on optimal organising for a collaborative crisis response is lacking and the research has focused on the views of emergency networks consisting of emergency professionals, aid workers and public managers as well as disaster relief operations.^{3–6,19–22} Although pharmaceutical professionals have had a central role in managing the COVID-19 crisis, cross-sector collaboration research on this topic remains lacking. We used

the following research questions to address this gap in the Finnish context:

- 1) How did pharmaceutical supply chain stakeholders organise cross-sector collaboration during the COVID-19 pandemic?
- 2) How did cross-sector collaboration influence the crisis management effectiveness?

Cross-sector collaboration is defined as the linking or sharing of information, resources, activities and capabilities by organisations in two or more sectors to jointly achieve an outcome that could not be reached by organisations in a single sector.^{23,24} Crisis management is defined as a set of preparatory and response activities to contain a threat and its consequences.²⁵

Research context

Finland’s pharmaceutical supply chain has a long tradition of interorganisational collaboration, defined by laws, regulations and contractual partnerships, as well as common healthcare responsibilities. The private, public and third sector stakeholders include government agencies, the pharmaceutical industry, wholesalers, community and hospital pharmacies, and advocacy organisations. Table 1 describes the stakeholders and their relevant legal mandates.

Table 1
Public, private and third sector pharmaceutical supply chain stakeholders relating to a pandemic crisis in Finland.

Public sector	Tasks mandated by legislation ^a
<p>Government agencies Description: Regulators of the pharmaceutical supply and operations Ministry of Social Affairs and Health (STM)</p> <p>Finnish Medicines Agency (FIMEA)</p> <p>National Institute for Health and Welfare (THL)</p> <p>The Social Insurance Institution of Finland (KELA)</p> <p>National Emergency Supply Agency (NESA)</p>	<p>Responsible for social and health policy, preparing legislation and guiding implementation</p> <p>Regulating pharmaceuticals, providing licensing, medical information and supervision, inspecting organisations, and developing the pharmaceutical supply and operations</p> <p>Responsible for communicable diseases, preparedness for health threats, national vaccine delivery and vaccine quality</p> <p>Responsible for decisions on pharmaceutical reimbursement applications and for developing the reimbursement system</p> <p>Coordinating the supply security with relevant organisations to maintain sufficient buffers and safeguarding the production of necessary goods and services under emergency conditions</p> <p>Responsible for pharmaceutical supply and logistics, ensuring medication quality and safety, providing clinical pharmacy and pharmaceutical manufacturing services in hospitals and primary care units, and maintaining for a two-week to 6 month need of specified pharmaceuticals</p>
<p>Hospital pharmacies Description: There are five public university hospitals and 16 central hospitals in Finland. Smaller hospitals may have dispensaries.</p>	
Private sector	Tasks mandated by legislation ^a
<p>Pharmaceutical industry Description: Manufacturing and importing companies that develop, produce, store and distribute medicines to wholesalers. They most often partner with one pharmaceutical wholesaler.</p> <p>Pharmaceutical wholesalers Description: Two major pharmaceutical wholesalers store and distribute almost 100% of pharmaceuticals in Finland.</p> <p>Community pharmacies Description: A total of 632 private community pharmacy owners held licences in Finland at the end of 2021^b. In addition, the University of Helsinki and the University of Eastern Finland each operate a pharmacy.</p>	<p>Ensuring quality and safety of pharmaceuticals in manufacturing, importation, storage and distribution. Maintaining for a 3-10 month need of specified pharmaceuticals</p> <p>Ensuring quality and safety of pharmaceuticals in storage and distribution</p> <p>Responsible for pharmaceutical supply and operations in their respective areas and for stocking for a two-week need of pharmaceuticals.</p>
Third sector	Tasks mandated by legislation ^a
<p>Advocacy organisations Description: Organisations that engage with government agencies on behalf of their members</p> <p>Pharma Industry Finland (PIF)</p> <p>Finnish Association for Generic Drugs (FAGD)</p> <p>Association of Finnish Pharmacies (AFP)</p>	<p>No legally mandated tasks</p> <p>No legally mandated tasks</p> <p>No legally mandated tasks</p>

^a Legal tasks have been simplified to ensure consistency and relevance.

^b The Association of Finnish Pharmacies, <https://www.apteekkariliitto.fi/apteekkitieto/apteekit-numeroina.html>; 2022 [accessed 12 Dec 2022].

Despite the presence of pharmaceutical manufacturing companies, pharmaceutical availability in Finland is highly import dependent. Thus, the pharmaceutical industry, wholesalers and hospital pharmacies are mandated by legislation to maintain specified pharmaceutical buffers to secure the supply during unexpected disruptions. Private community pharmacies and public hospital pharmacies ensure medication availability and safety in their respective areas. In addition, hospital pharmacies are responsible for vaccine logistics and distribution. The pharmaceutical industry manufactures and imports medicines to two main wholesaler companies that store and distribute medicines and vaccines to pharmacies.

Methods

A qualitative study with semi-structured interviews was designed to obtain an in-depth and holistic view of a complex and understudied subject.²⁶ Theory orientation was inductive.

Data collection

Purposeful selection was used to collect a representative sample of relevant stakeholders, who were leaders and specialists from the pharmaceutical industry and wholesalers (n = 9), community pharmacy owners (n = 9), hospital pharmacy heads (n = 6), government agency directors and officials (n = 5) and advocacy organisation representatives (n = 2) (Table 2). The primary selection criterion was the individual’s or organisation’s central role in pharmaceutical supply security during pandemic. The secondary selection criteria considered geographical dispersion, organisational size and function, and individuals’ strategic and operational roles. Informed consent was obtained from the participants through a preliminary information sheet containing a data protection notice.

A semi-structured interview protocol was developed (Appendix A). The literature review of collaborative crisis management guided the protocol development on four topics: organisation of cross-sector collaboration among pharmaceutical supply chain stakeholders during the COVID-19 pandemic, content of the collaboration and its influence on crisis management effectiveness, leadership and decision-making during crisis, and lessons learned.^{6,18,23,27} This study focused on the first two topics that included questions such as: ‘What kind of systematic or ad hoc collaboration did you have with pharmaceutical supply chain stakeholders during the pandemic?’, ‘What type of collaboration occurred in practice?’, ‘How did collaboration change during the crisis compared to normal times?’, ‘What kind of collaboration was the most important for you? Why?’, ‘What is the purpose of collaboration in the

pharmaceutical supply chain during a crisis?’, ‘How was the pandemic crisis managed in the Finnish pharmaceutical supply chain?’, and ‘Could you give concrete examples of crisis management efforts?’.

The protocol was evaluated in individual pilot interviews (n = 3) conducted in February–March 2021. The protocol was slightly adjusted based on feedback, allowing for the inclusion of pilot interviews in the data analysis. Individual (n = 26) and paired (n = 2) study interviews were conducted in March–May 2021 via Microsoft Teams (n = 29) or phone (n = 2), audio recorded and transcribed verbatim. They lasted from 37 to 106 min (average duration: 58 min). Two researchers participated in 27 of the 30 interviews, while three were conducted by one researcher. Each participant was given an opportunity to review his/her interview transcript for accuracy and to provide any necessary clarification via email. In total, 29 interview hours and 244 pages of interview data were studied.

Data analysis

Two researchers conducted a qualitative content analysis using Atlas.ti software (version 9.1.6.). They worked independently but regularly compared codes, categories and themes. Following Gioia et al. (2013), the research questions guided open coding during the first analysis step. Experiences of systematic and ad hoc inter-organisational collaboration on crisis management, including organisational structure details and the collaboration’s formation, aims, content and frequency, were captured. Likewise, experiences related to the collaboration’s purpose, and positive/negative examples influencing crisis management effectiveness were obtained. One researcher coded all transcripts (30/30), resulting in 814 quotations and 377 codes, and another coded half of them (15/30) to confirm the consistency of the emerging codes, resulting in 448 quotations and 286 codes.

All codes were analysed to ensure multivocal first-order concepts in the second step. The codes were categorised based on similarities/differences in connection with the research questions. Informant terms and codes were further categorised into second-order themes and then aggregate concepts. The researchers compared independent analyses, revisited the data and discussed similarities and discrepancies. The interview transcripts were compared to one another to reduce the bias of the participants’ self-evaluation of crisis management effectiveness and memory bias.¹⁰ In the third step, the researchers revisited the literature on collaborative crisis management. Figs. 1 and 2 present the example quotations, first-order concepts, second-order themes and aggregate concepts in the data structure for each research question, as guided by Gioia et al.’s (2013) methodology.²⁶

Table 2
Participants^a.

Private sector		Public sector		Third sector
Pharmaceutical industry and wholesalers	Community pharmacies	Hospital pharmacies	Government agencies	Advocacy organisations
Country Manager	Pharmacy Owner 1	Head of Pharmacy 1	Director 1	Representative 1
Director 1	Pharmacy Owner 2	Head of Pharmacy 2	Director 2	Representative 2
Director 2	Pharmacy Owner 3	Head of Pharmacy 3	Director 3	
General Manager 1	Pharmacy Owner 4	Head of Pharmacy 4	Official 1	
General Manager 2	Pharmacy Owner 5	Head of Pharmacy 5	Official 2	
General Manager 3	Pharmacy Owner 6	Head of Pharmacy 6		
Operational Manager	Pharmacy Owner 7			
Responsible Pharmacist 1	Pharmacy Owner 8			
Responsible Pharmacist 2	Pharmacy Owner 9			

^a Titles have been simplified, as needed, to ensure anonymity.

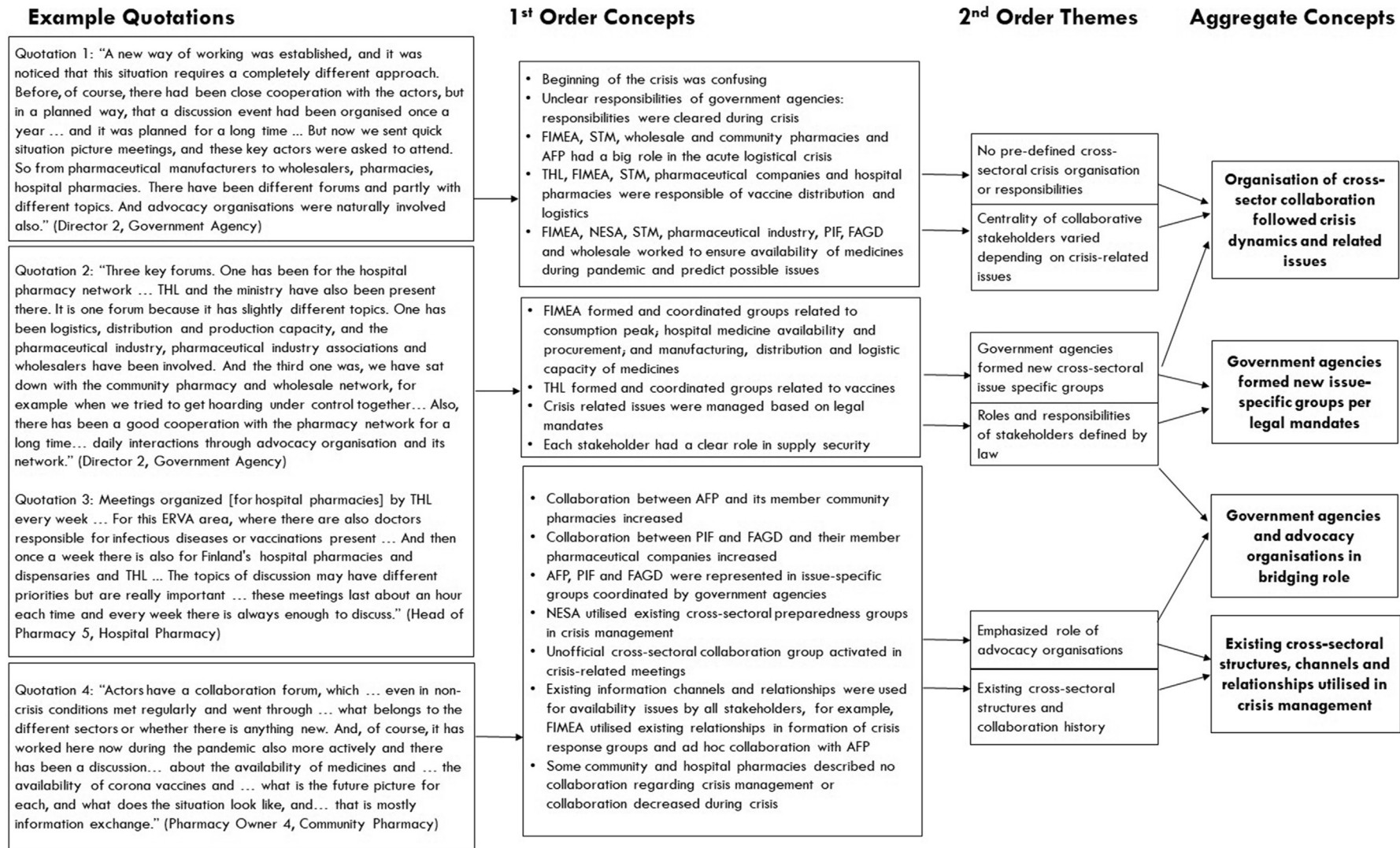


Fig. 1. Data structure: How did pharmaceutical supply chain stakeholders organise cross-sector collaboration during the COVID-19 pandemic? FIMEA = Finnish Medicines Agency; STM = Ministry of Social Affairs and Health; NESAs = Emergency Supply Agency; THL = National Institute for Health and Welfare; AFP = Association of Finnish Pharmacies; PIF = Pharma Industry Finland; FAGD = Finnish Association for Generic Drugs; ERVA = catchment area for highly specialised medical care.

Example Quotations

Quotation 1: 'Last spring, FIMEA and STM recommended that for certain medicinal products or groups of medicinal substances ... You should be prepared for the fact that the stocks would be slightly higher than normal ... There were negotiations with pharmaceutical companies and wholesalers, how to gradually raise the stocks to a higher level, so that a single hospital does not empty the stock, and then the stocks can be bought. It worked quite well; as soon as the needs were announced, a schedule was obtained, and the plan proceeded'. (Head of Pharmacy 3, Hospital Pharmacy)

Quotation 2: 'A couple of weeks ago, I received a message from FIMEA that I had actually been waiting for a year now, but I was still happy when it came ...: "In relation to three medicinal substances, we ask you to ensure that you have sufficient stocks and to prepare for a possible higher-than-normal expenditure"'. (Head of Pharmacy 1, Hospital Pharmacy)

Quotation 3: 'The Association of Finnish Pharmacies has, in a very good way, made information bases ready for us ... It would have been quite a lot of hard work, considering everything, such as instructions for customers and staff and whatever changed, especially when they change from time to time, so it was a really big help'. (Pharmacy Owner 9, Community Pharmacy)

Quotation 4: 'We spent hours searching for the requested information... So we were really busy last spring. And then together with FIMEA, we started to think about what other ways there could be for this, and luckily, STM and FIMEA came up with their own solutions ... We were then involved in commenting, among other things, so that we reached that agreement a while ago ... About data collection'. (Head of Pharmacy 3, Hospital Pharmacy)

First-order Concepts

- Member companies informed PIF and FAGD about potential and actual issues in logistic, distribution and manufacturing. PIF and FAGD forwarded information and suggested actions to NESAs, FIMEA and STM, which implemented relevant corrective actions.
- PIF and FAGD informed FIMEA and NESAs about the situation in Europe.
- Pharmaceutical companies were directly in contact with NESAs regarding shipping problems, border controls and manufacturing chain issues.
- AFP, PIF, FAGD, the pharmaceutical industry and wholesale, community and hospital pharmacies shared their operational performance and potential issues with one another and with FIMEA and NESAs, which informed STM.
- STM and FIMEA informed stakeholders about upcoming legal changes and situations.
- Member pharmacies informed AFP about problems related to increased consumption. AFP forwarded information and suggested actions to FIMEA, STM and KELA, which implemented relevant corrective actions.
- Hospital pharmacies informed industry and wholesalers about upcoming large orders in which the medicines will be distributed equally to pharmacies.
- THL, pharmaceutical companies and hospital pharmacies shared information on vaccine characteristics, logistics, storage and distribution.
- More information and guidance regarding emergency medicines were emphasised by hospital pharmacies.

- AFP, PIF and FAGD provided clarifications on legal changes and regulations to their member companies, as well as assisted in the implementation of requirements.
- AFP provided a crisis management template and guidance on crisis-related issues, such as mask and disinfectant orders, preparation of hand disinfectants and health protection, to its member pharmacies.

- The automation of requests for information in collaboration with FIMEA, STM and stakeholders enabled saving time and ensured the visibility of medical stocks for hospital and community pharmacies and wholesalers, as well as enabled the calculation of different scenarios in consumption and sufficient storage.
- Development and organisation of ultra-cold vaccine logistics, as well as warehousing and distribution in collaboration with THL, hospital pharmacies and pharmaceutical company
- Driving prioritisation of drug transport in ship freight by the stakeholders of unofficial cross-sectoral collaboration groups

Second-order Themes Aggregate Concepts

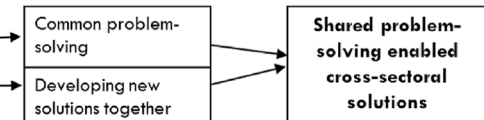
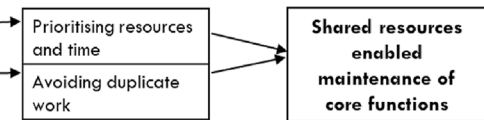
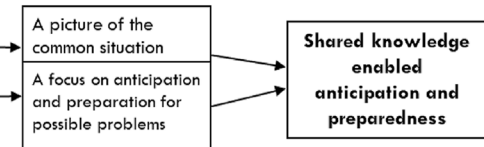


Fig. 2. Data structure: How did cross-sector collaboration influence the crisis management effectiveness? FIMEA = Finnish Medicines Agency; STM = Ministry of Social Affairs and Health; NESAs = Emergency Supply Agency; THL = National Institute for Health and Welfare; KELA = The Social Insurance Institution of Finland; AFP = Association of Finnish Pharmacies; PIF = Pharma Industry Finland; FAGD = Finnish Association for Generic Drugs.

Results

Organisation of cross-sector collaboration

Based on the results, a new conceptual model was developed to describe the organisation of collaborative crisis management (Fig. 3). The model illustrates the connections between four aggregate concepts: 1) existing cross-sectoral structures, collaboration channels and relationships were utilised in crisis management; 2) crisis dynamics and related issues guided group formation and meeting frequency; 3) government agencies formed new issue-specific groups as per legal mandates; and 4) government agencies and advocacy organisations played a bridging role.

The beginning of the pandemic was confusing and ‘extinguishing fires’ (Head of Pharmacy 2, Hospital Pharmacy), with unclear contact points for various situations. Moreover, sources provided conflicting information. Although legislation described stakeholders’ roles and responsibilities, accountability for crisis-related issues had to be clarified during the crisis. Without a predefined cross-sectoral crisis organisation, collaboration was organised based on existing structures, channels and relationships and through the establishment of issue-specific groups by government agencies as per legal mandates. Crisis dynamics and related issues guided the group formation and meeting frequency (Quotation 1, Fig. 1).

Existing groups, collaboration channels and relationships were utilised in crisis management

Advocacy organisations, Pharma Industry Finland (PIF), the Finnish Association for Generic Drugs (FAGD) and the Association of Finnish Pharmacies (AFP) organised member company discussions, supported problem-solving efforts and shared information on regulation changes and recommendations. The AFP provided guidance on medicine availability, hygiene controls and masks, and provided a crisis management plan template for community pharmacies. Advocacy organisations played a bridging role between their member companies and government agencies by forwarding problems to the authorities (Fig. 3). The National Emergency Supply Agency (NESA) requested information from its

contact persons from the pharmaceutical industry and wholesalers frequently; however, the meeting frequency of existing preparedness groups for the chemistry and healthcare fields did not increase significantly, and the utility of the meetings for the study participants varied. NESA helped pharmaceutical manufacturing in Finland by providing real-time information on boarding foreign professionals, assisting shipping companies to ensure freight service, and prioritising pharmaceutical transport trucks for urgent delivery needs.

An informal cross-sectoral group of representatives of the AFP, PIF, FAGD, community and hospital pharmacies, the pharmaceutical industry and wholesalers was formed to discuss ongoing regulatory changes before the pandemic (Quotation 4, Fig. 1). The group had a rotating convener role instead of a coordinating actor and normally met few times a year. At the beginning of the pandemic, the group activated rapidly and formed a sub-group for pandemic issues affecting the pharmaceutical supply chain. The sub-group met multiple times a week during spring 2020. As common issues became rarer, the meeting frequency decreased. The group shared information on current issues and operating performance and helped members maintain a dynamic, common operating picture of the supply chain function. Hospital pharmacy representative informed pharmaceutical companies and wholesalers about large upcoming orders, and pharmaceutical companies informed others about possible availability disruptions. When freight medicine shipments were in danger of being stopped, participants brought the problem to government agencies via multiple voices.

Government agencies’ focus on solving crisis-related issues as per legal mandates

New cross-sectoral groups focusing on solving different crisis-related issues were formed by government agencies. By coordinating these groups, the Finnish Medicines Agency (FIMEA) and the National Institute for Health and Welfare (THL) played a bridging role between stakeholders (Fig. 3). Despite many collaborative groups working simultaneously, there was ‘surprisingly little overlapping’ (Director 1, Government Agency). Meeting frequency varied based on current needs. The cross-sectoral groups dealing with medicine and vaccine availability are described below.

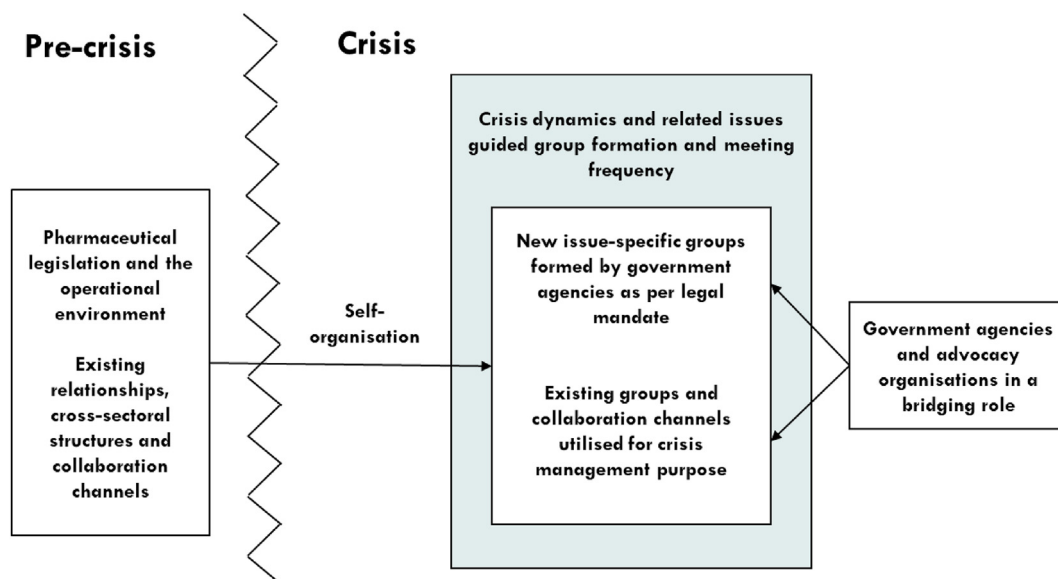


Fig. 3. Process model: Organisation of collaborative crisis management.

Medicine consumption peak in community pharmacies affected wholesalers through massive order increase, escalating to a logistical crisis because wholesalers did not have the capacity to respond to the increased consumption. FIMEA formed a group for information sharing between wholesalers and community pharmacies to solve consumption peak issues (Quotation 2, Fig. 1). The meeting frequency was high during the acute crisis. FIMEA redirected relevant information to the Ministry of Social Affairs and Health (STM), which prohibited medicine overstocking and restricted the bronchodilator (salbutamol) supply to a one-month maximum treatment period based on the Emergency Powers Act.^{28–30} Issues related to daily pharmacy work were shared in the group and in direct interactions with AFP and FIMEA and, for example, forwarded to the Social Insurance Institution of Finland (KELA), enabling flexibility in prescription medicine delivery intervals and remote services.

Medicine logistics and production and distribution capacities were discussed in a group of pharmaceutical industry, wholesalers, PIF and FAGD representatives coordinated by FIMEA. The global medicine availability, the European situation, the national production and distributions' operational performance status, border controls and potential issues were discussed. FIMEA shared relevant information from these meetings with STM and NESAs.

FIMEA also formed a group including hospital pharmacy, STM and THL representatives. Medicine delivery to emergency departments and established COVID-19 wards relied on the function of hospital pharmacies, so information about medical treatments, availability issues and pharmacies' operational performance status was shared between participants. The procurement of emergency medicines and other COVID-19-related pharmaceuticals was discussed.

Organising COVID-19 vaccine logistics began at the end of 2020. As the first vaccines arrived during the Christmas holidays, pharmaceutical company and THL worked remote 'at Christmas tables' to ensure urgent vaccine delivery to Finland (Director 2, Pharmaceutical industry and wholesale). THL held regular meetings with COVID-19 vaccine marketing authorisation holders and wholesalers regarding logistics and vaccine characteristics. THL coordinated regular meetings with all hospital pharmacies and dispensaries and separate meetings with clinicians responsible for infectious diseases or vaccinations and hospital pharmacists from highly specialised medical care catchment areas (Quotation 3, Fig. 1).

The influence of cross-sector collaboration on crisis management effectiveness

This research identified three concepts on how cross-sector collaboration influenced crisis management effectiveness (Fig. 2). First, shared knowledge enabled the anticipation of and preparedness for potential availability and operating issues throughout the pharmaceutical supply chain. Member organisations informed PIF, FAGD and AFP about potential and actual logistic, distribution, manufacturing and operational performance issues; information was forwarded to relevant government agencies that implemented corrective actions. Constant information exchange helped stakeholders form a dynamic common situation picture and plan actions in line with others (Quotation 1, Fig. 2). Hospital pharmacy representatives who were not involved in collaborative groups in the early crisis described a lack of information on the needed emergency medicines, preparation for increasing consumption and what to do in sales restrictions (Quotation 2, Fig. 2). This emphasised the importance of knowledge sharing.

Second, shared resources enabled maintenance of core functions. AFP, PIF and FAGD helped their member companies concentrate on daily operations and saved their time by unpacking

regulations, creating guidance regarding masks and hygiene controls and advocating for them in multiple cross-sectoral groups. This was particularly pronounced in community pharmacies that were able to prioritise resources to ensure pharmaceutical supply and service continuity (Quotation 3, Fig. 2).

Third, shared problem-solving enabled cross-sectoral solutions. In the early pandemic, FIMEA made frequent information requests to hospital pharmacies about pharmaceutical stocks. As these were laborious and time-consuming, FIMEA and STM, in collaboration with stakeholders, developed an automated data collection system to enable real-time stock visibility at wholesalers, hospital and community pharmacies. This enabled FIMEA to react quickly to potential availability problems and reduced the work at hospital pharmacies (Quotation 4, Fig. 2). Other cross-sectoral problem-solving examples included organising ultra-cold logistics, warehousing and distribution to ensure vaccine preservation and safety in collaboration with THL, hospital pharmacies and pharmaceutical company, and driving drug transport prioritisation in ship freight by the participants of the unofficial cross-sectoral collaboration group.

Discussion

Consistent with the present findings, previous studies have described the importance of pre-existing interorganisational structures and repeated collaboration prior to a crisis.^{13,16,18} Studies also show how the legal and administrative mandates affect the cross-sectoral collaboration structure in non-crisis settings.^{23,31,32} However, crisis management research has claimed that the impact of legislation, technical equipment and a formal structure is overrated compared to that of network building, leadership and training.^{3,13} The present study indicates that legislation provides necessary mandates for government agencies and clarifies stakeholder roles. Despite legal obligations in material preparedness, NESAs did not play a bridging role in the collaborative pandemic response of the pharmaceutical supply chain. Instead, FIMEA and THL took over that role, focusing on solving crisis-related issues according to their mandates.

According to previous research, in the absence of a predefined crisis management governance structure, interorganisational collaboration self-organises to overlapping networks.^{6,15,16} In contrast, no overlapping was found in this study. Pandemic-related issues guided group formation and meeting frequency of various groups. Collaboration partners had common issues and interdependent roles in problem-solving. Recent research suggests that actor and task interdependency relate to the effectiveness of multi-agency response.^{17,33} This study supports the suggestion and adds knowledge about issue-specific groups.

Previous studies illustrate the importance of public-nonprofit^{4,16,18} and public-private³⁴ partnerships in crises. Private-third sector collaboration has been studied in a non-crisis and disaster relief context.^{5,35} The present study extends that focus by illustrating the third sector's central role in supporting the private and public sectors during the pandemic. Advocacy organisations shared information and resources with member companies, provided information on issues and operational performance with government agencies, and participated in problem-solving in collaborative groups. Advocacy organisations were selected for groups formed by FIMEA, as they combined information from member companies and represented a national perspective.

Practical implications

The present study emphasises two practical implications. First, cross-sectoral crisis preparedness plans and rehearsal should focus

on selected problems affecting various sector stakeholders, such as consumption peaks, core function interruptions and logistical challenges that may arise in different crises.^{6,13,14,36} As many of these problems are predictable, solutions, potential accountability gaps and collaboration partners can be considered prior to a crisis to some extent. Breaking complex problems into manageable pieces, task interdependency, preparing, simulating and exercising for adaptive and networked responses build a good ground for an agile and effective crisis response.^{6,13,14,36,37} Second, organising around common (also non-crisis-related) incentives during normal times would enhance preparedness and learning and reduce duplicate work and information gaps during crises. Organising through advocacy organisations and informal cross-sectoral stakeholder group showed good examples of utilising existing networks for crisis management purposes.

Study limitations and future research avenues

Some important information may have been omitted because of the limited number of interviews and the focus on leaders instead of employees. As the interviews were held one year after the pandemic's acute phase, a possible recall bias in the responses may have also existed. Moreover, national, European and global pandemic responses, other industries, and the healthcare and local infrastructure affect Finland's pharmaceutical supply chain, but these considerations were excluded in the study. Finland has a unique pharmaceutical sector set-up, and professionals know one another well in this small country, so caution is recommended in considering the results to other settings. Furthermore, inter-organisational and interagency collaboration within sectors was excluded to focus on cross-sectoral collaboration. Finally, although the influence of cross-sector collaboration on crisis management effectiveness was explored qualitatively based on the participants' experiences, it was not measured quantitatively.

More research on collaborative crisis management in healthcare and other specialized industries is needed. Studies could compare the effectiveness of issue-specific and other forms of organising. Future research could also explore crisis preparedness, response and recovery in community and hospital pharmacies and the pharmaceutical industry based on crisis management theory.

Conclusion

This was the first study to explore cross-sector collaboration among pharmaceutical supply chain stakeholders during a crisis. It presented a new illustration of organising for collaborative crisis management and added knowledge about private-third sector collaboration and issue-specific groups to the cross-sector collaboration and crisis management literature. Without a predefined crisis management organisation, cross-sector collaboration was organised based on previous collaboration structures, channels and relationships and through the establishment of issue-specific groups by government agencies as per legal mandates. The third sector was an important collaborative partner for the private and public sectors. Cross-sector collaboration was shown to be necessary for coordinating crisis management efforts. Sharing knowledge, resources and problem-solving increased the effectiveness of crisis management. Furthermore, this study adds value to practice by describing and analysing pharmaceutical supply chain stakeholders' pandemic responses and suggesting two practical implications. More research on collaborative crisis management in the healthcare context is needed to improve preparedness for future crises.

Author statements

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Ethical approval

The study data were collected, stored and handled based on local data protection instructions. A data protection notice was provided to the participants, and informed consent was obtained prior to data collection. The participants were also provided with information about voluntary participation and the possibility of withdrawing from the study at any time. Personal identifiers were deleted from the transcripts. According to Finnish National Board on Research Integrity guidelines, ethical approval was not required for this study.

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Competing interests

S.H. Latonen: The author received a grant from the Association of Finnish Pharmacies for doctoral research and conducted the present study at the University of Helsinki, Finland, during study leave. The author is employed by Novo Nordisk Farma Oy. The author has no conflicts of interest to declare.

R. M. Suominen, A. M. Juppo, H. Seeck, and M. Airaksinen: None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2023.06.042>.

References

1. Socal MP, Sharfstein JM, Greene JA. The pandemic and the supply chain: gaps in pharmaceutical production and distribution. *Am J Publ Health* 2021;**111**(4): 635–9. <https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2020.306138>.
2. Fox ER, McLaughlin MM. ASHP guidelines on managing drug product shortages. *Am J Health Syst Pharm* 2022;**75**(21):1742–50. <https://academic.oup.com/ajhp/article/75/21/1742/5160014>.
3. Waugh WL, Streib G. Collaboration and leadership for effective emergency management. *Publ Adm Rev* 2006;**66**(s1):131–40. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6210.2006.00673>.
4. Simo G, Bies AL. The role of nonprofits in disaster response: an expanded model of cross-sector collaboration. *Publ Adm Rev* 2007;**67**(s1):125–42. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6210.2007.00821>.
5. Maon F, Lindgreen A, Vanhamme J. Developing supply chains in disaster relief operations through cross-sector socially oriented collaborations: a theoretical model. *Supply Chain Manag* 2009;**14**(2):149–64. <https://research.cbs.dk/en/publications/developing-supply-chains-in-disaster-relief-operations-through-cr>.
6. Nohrstedt D, Bynander F, Parker C, 't Hart P. Managing crises collaboratively: prospects and problems—a systematic literature review. *Perspect Public Manag Gov* 2018;**1**(4):257–71. <https://doi.org/10.1093/ppmgov/gvx018>.
7. Parker CF, Nohrstedt D, Baird J, Hermansson H, Rubin O, Baekkeskov E. Collaborative crisis management: a plausibility probe of core assumptions. *Polic Soc* 2020;**39**(4):510–29. <https://doi.org/10.1080/14494035.2020.1767337>.

8. Comfort LK. Crisis management in hindsight: cognition, communication, coordination, and control. *Publ Adm Rev* 2007;**67**(s1):189–97. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6210.2007.00827>.
9. Wolbers J, Boersma K. The common operational picture as collective sense-making. *J Contingencies Crisis Manag* 2013;**21**(4):186–99. <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-5973.12027>.
10. Hermansson H. Disaster response in Turkey: conditions promoting cross-sectoral collaboration and implications for effectiveness. *Adm Soc* 2016;**51**(7):1051–78. <https://journals.sagepub.com/doi/abs/10.1177/0095399716680058?journalCode=aasb>.
11. Moynihan DP. The network governance of crisis response: case studies of incident command systems. *J Publ Adm Res Theor* 2009;**19**(4):895–915. <https://doi.org/10.1093/jopart/mun033>.
12. Moynihan DP. Learning under uncertainty: networks in crisis management. *Publ Adm Rev* 2008;**68**(2):350–65. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6210.2007.00867>.
13. Boin A, 't Hart P. Organising for effective emergency management: lessons from research. *Aust J Publ Adm* 2010;**69**(4):357–71. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-8500.2010.00694>.
14. Chen J, Chen THY, Vertinsky I, Yumagulova L, Park C. Public–private partnerships for the development of disaster resilient communities. *J Contingencies Crisis Manag* 2013;**21**(3):130–43. <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-5973.12021>.
15. Kendra JM, Wachtendorf T. Elements of resilience after the world trade center disaster: reconstituting New York city's emergency operations centre. *Disasters* 2003;**27**(1):37–53. <https://onlinelibrary.wiley.com/doi/full/10.1111/1467-7717.00218>.
16. Kapucu N. Public-nonprofit partnerships for collective action in dynamic contexts of emergencies. *Publ Adm* 2006;**84**(1):205–20. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.0033-3298.2006.00500>.
17. Ó Bodin, Guerrero AM, Nohrstedt D, Baird J, Summers R, Plummer R, et al. Choose your collaborators wisely: addressing interdependent tasks through collaboration in responding to wildfire disasters. *Publ Adm Rev* 2022;**82**(6):1154–67. <https://onlinelibrary.wiley.com/doi/full/10.1111/puar.13518>.
18. Curnin S, O'Hara D. Nonprofit and public sector interorganizational collaboration in disaster recovery: lessons from the field. *Nonprof Manag Leader* 2019;**30**(2):277–97. <https://onlinelibrary.wiley.com/doi/abs/10.1002/nml.21389>.
19. Kapucu N, Arslan T, Demiroz F. Collaborative emergency management and national emergency management network. *Disaster Prev Manag* 2010;**19**(Journal Article):452–68.
20. Nohrstedt D. Explaining mobilization and performance of collaborations in routine emergency management. *Adm Soc* 2016;**48**(2):135–62. <https://doi.org/10.1177/0095399712473983>.
21. Butts C, Acton R, Marcum C. Interorganizational collaboration in the hurricane Katrina response. *J Soc Struct* 2012;**13**:1–36.
22. Nolte IM, Martin EC, Boenigk S. Cross-sectoral coordination of disaster relief. *Publ Manag Rev* 2012;**14**(6):707–30. <https://doi.org/10.1080/14719037.2011.642629>.
23. Bryson JM, Crosby BC, Stone MM. The design and implementation of cross-sector collaborations: propositions from the literature. *Publ Adm Rev* 2006;**66**(s1):44–55. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6210.2006.00665>.
24. Bryson JM, Crosby BC, Stone MM. Designing and implementing cross-sector collaborations: needed and challenging. *Publ Adm Rev* 2015;**75**(5):647–63. <https://onlinelibrary.wiley.com/doi/abs/10.1111/puar.12432>.
25. Ansell C, Boin A. Taming deep uncertainty: the potential of pragmatist principles for understanding and improving strategic crisis management. *Adm Soc* 2019;**51**(7):1079–112. <https://doi.org/10.1177/0095399717747655>.
26. Gioia DA, Corley KG, Hamilton AL. Seeking qualitative rigor in inductive research: notes on the Gioia methodology. *Organ Res Methods* 2013;**16**(1):15–31. <https://doi.org/10.1177/1094428112452151>.
27. Hesse A, Kreutzer K, Diehl MR. Dynamics of institutional logics in a cross-sector social partnership: the case of refugee integration in Germany. *J Bus Ethics* 2019;**159**(3):679–704. https://ideas.repec.org/a/kap/jbuset/v159y2019i3d10.1007_s10551-017-3775-0.html.
28. Ministry of Social Affairs and Health. *The adequacy of medicines and the functioning of the pharmaceutical supply chain are ensured by a decision of the Ministry of Social Affairs and Health*. 2020. <https://stm.fi/-/paatos>. [Accessed 5 September 2022].
29. Tiirinki H, Tynkkynen LK, Sovala M, Atkins S, Koivusalo M, Rautiainen P, et al. COVID-19 pandemic in Finland – preliminary analysis on health system response and economic consequences. *Health Policy Technol* 2020;**9**(4):649–62. <http://www.sciencedirect.com/science/article/pii/S2211883720300770>.
30. Ministry of Social Affairs and Health. *Ministry's decisions ensure the availability of pharmaceutical products and the functioning of the supply chain*. 2020. <https://stm.fi/-/stm-n-paatoksilla-varmistetaan-laakevalmisteiden-saatavuutta-ja-jakeluketjun-toimivuutta>. [Accessed 5 September 2022].
31. Cornforth C, Hayes JP, Vangen S. Nonprofit–public collaborations: understanding governance dynamics. *Nonprofit Voluntary Sect Q* 2015;**44**(4):775–95. <http://journals.sagepub.com/doi/10.1177/0899764014532836>.
32. Siddiki SN, Carboni JL, Koski C, Sadiq AA. How policy rules shape the structure and performance of collaborative governance arrangements. *Publ Adm Rev* 2015;**75**(4):536–47. <https://onlinelibrary.wiley.com/doi/abs/10.1111/puar.12352>.
33. Bodin Nohrstedt D. Formation and performance of collaborative disaster management networks: evidence from a Swedish wildfire response. *Global Environ Change* 2016;**41**:183–94.
34. Kim S, Goh Y, Kang JHB. Moving toward a common goal via cross-sector collaboration: lessons learned from SARS to COVID-19 in Singapore. *Glob Health* 2022;**18**(1):1–18. <https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-022-00873-x>.
35. Dahan NM, Doh JP, Oetzel J, Yaziji M. Corporate-NGO collaboration: co-creating new business models for developing markets. *Long Range Plan* 2010;**43**(2–3):326–42.
36. Kettl DF. Contingent coordination practical and theoretical puzzles for homeland security. *Am Rev Publ Adm* 2003;**33**(3):253–77.
37. Richmond JG, Tochkin J, Hertelendy AJ. Canadian health emergency management professionals' perspectives on the prevalence and effectiveness of disaster preparedness activities in response to COVID-19. *Int J Disaster Risk Reduc* 2021;**15**(60):102325.