

Civil–military cooperation in the management of infectious disease outbreaks: a scoping review

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ABSTRACT

Introduction Civil–military cooperation (CMC) in infectious disease outbreak responses has become more common, and has its own cooperation dynamics. These collaborations fit WHO’s call for multisectoral cooperation in managing health emergencies according to the emergency management cycle (EMC). However, the literature on CMC on this topic is fragmented. The core aim of this review is to understand the breadth and dynamics of this cooperation by using the EMC as a framework and by identifying challenges and opportunities in the management of outbreaks.

Methods A scoping review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews guideline was conducted. A systematic search for peer-reviewed journals was performed in PubMed, Embase, Web of Science and Scopus. Eligible papers addressed substantive contributions to the understanding of CMC. Papers were categorised by EMC phase and relevant information on study characteristics and areas of cooperation were extracted from the data. Recurring themes on challenges and opportunities in cooperation were identified by means of qualitative interpretation analysis.

Results The search resulted in 8360 papers; 54 were included for analysis. Most papers provided a review of activities or expert opinions. CMC was described in all EMC phases, with the fewest references in the recovery phase (n=1). In total, eight areas of CMC were explored. Regarding the better understanding of cooperative dynamics, the qualitative analysis of the papers yielded five recurring themes covering challenges and opportunities in CMC: managing relations, framework conditions, integrating collective activities, governance and civil–military differences.

Conclusion Guided by these five themes, successful CMC requires sustainable relations, binding agreements, transparency, a clear operational perspective and acknowledgement of organisational cultural differences. Early and continuous engagement proves crucial to avoid distrust and tension among stakeholders, frequently caused by differences in strategic goals. Original research on this topic is limited.

INTRODUCTION

Armed services are increasingly involved in global health, including in the response to

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Sustainable capacities for joint (civil–military) outbreak management should be built on the full cycle of prevention, preparedness, readiness, response and recovery.

WHAT THIS STUDY ADDS

⇒ Military involvement can boost projects, campaigns and emergency responses in most phases of the emergency management cycle (EMC).

⇒ Liaisons, collective education and exercises can provide a more solid base and lead to continuous engagement between civilian and military stakeholders to support their successful cooperation.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE AND/OR POLICY

⇒ The currently developed plans for future pandemics provide an opportunity to involve the military in an early stage, considering cooperation in every EMC phase.

⇒ The five identified recurring themes provide a basis for future analysis of the primarily national orientated COVID-19 outbreak responses and the contextual differences between domestic and international military deployments in outbreak management.

outbreaks of infectious diseases, both domestically and internationally.^{1 2} For example, in 1997, the US Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) was established to support global infectious disease surveillance.³ In 2016 around 200 000 Brazilian military personnel assisted local government during the Zika virus outbreak.^{4 5} And during the 2014–2015 Ebola outbreak in West Africa, national militaries were deployed domestically, and Liberia and Sierra Leone received foreign military assistance from over 5200 international troops from 6 different countries, which provided health workers, treatment units and laboratories.⁶ One

explanation for this growing military role is that, from the 1990s, infectious diseases have often been considered as (inter)national security threats. Concurrently, militaries have been increasingly given a role in health emergency planning and response.¹⁻⁷ Most countries have made provisions in national law to embed military support to civil authorities, including support during outbreaks. Collaboration between military and civil stakeholders to enhance health security is in line with WHO policy. WHO underpins the need for more cooperation across sectors to prepare for and respond to health emergencies.⁸⁻⁹ During the COVID-19 pandemic, large-scale national cooperation between armed forces and health authorities became manifest, mainly by supporting overwhelmed local healthcare systems.¹⁰

While the world is still responding to the current pandemic, the WHO is releasing plans to tackle future health emergencies, including outbreaks.⁹ Military assistance to civil authorities is part of these plans and, consequently, civil-military cooperation (CMC) will continue in public health emergencies. Despite these developments, the literature on CMC in this area is still fragmented.

Objective

The military is a self-sustaining organisation by design, rarely embedded in civilian health crises systems. Therefore, it can be expected that cooperation with civilian stakeholders is often ad-hoc and convoluted. Consequently, it often has its own specific dynamics between cooperating stakeholders. The aim of this review is to provide insight into the dynamics of CMC by identifying challenges and opportunities related to the management of infectious disease outbreaks. It aims to integrate existing knowledge, identify core themes, define research gaps and offer suggestions for further research. Moreover, the review's findings may serve to improve future collaborations. The research question is formulated as follows: 'What are the known opportunities and challenges related to medical CMC in the management of infectious disease outbreaks?'

Within the scope of this paper, medical CMC refers to projects or activities where civil and military partners collaborate in the medical field to manage and resolve infectious disease outbreaks. Security-related activities are excluded. Civil stakeholders are (inter)national non-military-based actors representing intergovernmental, governmental, non-governmental and civil society organisations. Military stakeholders are (inter)national military forces providing military personnel, knowledge, equipment, supplies or services.

Conceptual framework

The WHO, among other organisations, states that managing health crises requires actions throughout multiple phases.¹¹ These phases are captured in the emergency management cycle (EMC) and typically consist of: prevention, preparedness, response and recovery. The



Figure 1 Full emergency management cycle.

WHO, the world's primary organisation in global health, considers 'readiness' an important, additional phase in the EMC, so we incorporate it as well (figure 1).¹¹ The EMC framework is valuable because it allows for the identification of phase-specific interventions, providing a structured organisational framework for complex cooperation throughout health crises, including managing infectious disease outbreaks. As such, its use has been recommended in the literature.¹¹² Therefore, we choose to use the EMC to break down and analyse CMC dynamics and processes in each phase of the cycle. The EMC has limitations, because it suggests a rigid separation of phases throughout the cycle, while in practice phases overlap and phase-related activities may serve more than one phase at a time. For reasons of structure and clarity, however, we consider each phase separately in this study. To emphasise that this review includes the full EMC, the research question intentionally uses 'the management of outbreaks', rather than the term 'outbreak preparedness and response'. Literature gaps regarding cooperation during specific EMC phases may be revealed, offering grounds for further analysis.

Defining EMC phases

Although the WHO refers to the EMC, the five separate phases lack clear definition in the above-referred to document. Therefore, definitions from other WHO documents are used and applied to infectious disease outbreaks.¹³⁻¹⁵ Full original WHO definitions are given in online supplemental appendix 1. The prevention phase primarily refers to actions aimed at avoiding the manifestation of outbreaks, while the preparedness phase requires plans and activities to strengthen overall capacity and capability of a country or community to efficiently manage outbreaks and recover from them. The readiness phase is the interface between preparedness actions and the immediate response to any outbreak. The response phase comprises actions taken during or immediately after an outbreak, aiming to save lives and reduce health impacts. The recovery phase aims to re-establish or improve livelihoods, health and health systems in an infectious disease outbreak-affected community or society.

METHODS

A scoping review was conducted by a systematic search and findings are presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews guidelines.¹⁶

Identifying relevant studies

Our research team consisted of medical specialists in public health and military medicine, social sciences specialists on CMC and healthcare governance, and an information specialist. A systematic search was performed in the following databases: PubMed, Embase.com, Clarivate Analytics/Web of Science Core Collection and Scopus. The timeframe within the databases was from inception to 14 June 2021 and conducted by GLB and JJ. The search included keywords and free text terms for (synonyms of) ‘military’ or ‘armed forces’ combined with (synonyms of) ‘collaboration’ or ‘partnerships’ combined with (synonyms of) ‘disease outbreaks’ or ‘infectious disease’. A full overview of the search terms per database is listed in the supplementary information

(online supplemental appendix 2). All relevant articles and reviews from peer-reviewed journals have been included. Books and dissertations, conference abstracts and conference papers were excluded. No limitations on date or language were applied in the search. The databases were searched for an initial run on 2 November 2020. A rerun for all databases took place on 14 June 2021. After deduplication in Endnote, the papers were imported to the Rayyan web tool for further selection.¹⁷ By citation screening eligible references from included papers were added.

Study selection

The eligibility criteria for screening and selection were applied to papers derived from the search and shown in figure 2. Rather than listing or summarising military activities while managing outbreaks, this review studies the interaction between civilian and military stakeholders during cooperation. Papers must provide a contribution to the understanding of CMC by means of a substantive description, analysis or evaluation of collaboration activities. Full text had to be available via university libraries or

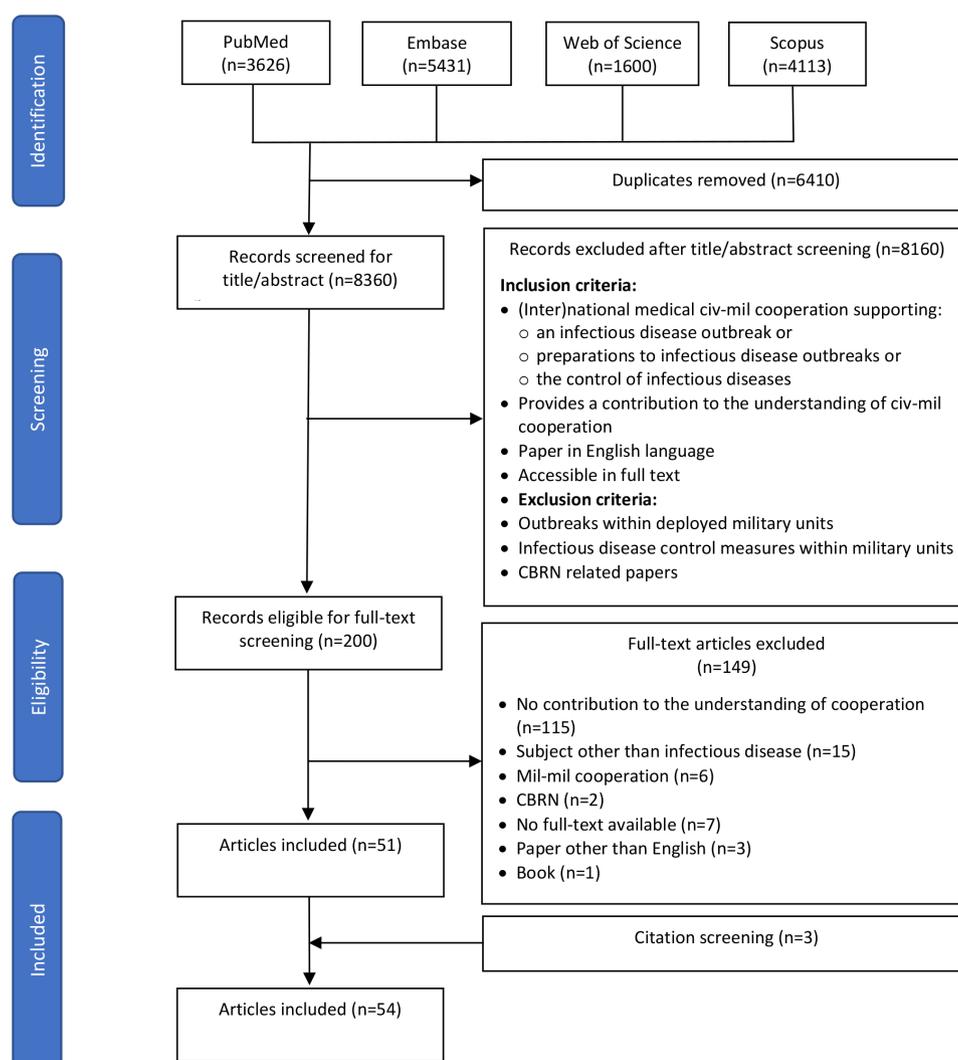


Figure 2 Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews flowchart on the eligibility screening process.

open access. To ensure transparency and allow for replication, only papers in English were included. Disease control measures within military units such as vaccination, prophylaxis or impregnated military suits were excluded, as were papers about intentional chemical, biological, radiological and nuclear threats.

The title/abstracts of 11.3% (of 7584, selected from the first run sample) were blinded and screened by two reviewers simultaneously, n=858 (JJ and JPK). Disagreement was found in 0.6% of the records (n=5). For title/abstracts, 3.7% were scored by at least one as 'maybe' (n=32). Both reviewers discussed disagreements until consensus was reached; 18 records were included. A third researcher delivered the final judgement (AT). Subsequently, both reviewers (JJ and JPK) continued the title/abstract screening independently. Next, JJ performed full-text selection in close consultation with JPK.

Charting data and synthesis of results

Extracted data of included papers was collected in Microsoft Excel by one reviewer (JJ) for baseline characteristics such as author, year of publication, journal, country of first author's affiliated institute, first author's civil or military affiliation and type of study. Papers were categorised following the five EMC phases. A second reviewer (APCCHB) performed the same procedure for 11 randomly selected articles. Uncertainties were discussed and resolved. Next, per EMC phase, described activities in CMC were retrieved from the papers and clustered in common topics, representing identified areas of cooperation.

Next, recurrent themes concerning challenges and opportunities of CMC were identified through Braun and Clark's qualitative thematic interpretation analysis.¹⁸ First, a list was generated of meaningful fragments from each paper, relevant to answer the research question. This was followed by an extensive, iterative process of manual inductive coding to find recurring themes on challenges and opportunities in cooperation. One reviewer (JJ) performed this analysis in close consultation with JPK, cross-checked by a second reviewer (APCCHB) for ten randomly selected articles. Again, uncertainties were discussed and resolved between the reviewers.

Patient and public involvement

Patients or public were not involved in any part of the study.

RESULTS

After screening and selection of 8360 search results, 54 papers were included. The PRISMA flowchart illustrates the search strategy and article selection (figure 2). In the following section, baseline characteristics and categorisation by EMC phases are presented in table 1. Then, the specific areas of CMC per phase are presented in table 2, followed by an extensive elaboration on the identified recurring themes in table 3.

Baseline characteristics

Table 1 shows the baseline characteristics of 54 selected papers. The majority of papers review specific activities (52%; n=28) or provide expert opinions (28%; n=15). Overall, 19% of studies are original research (n=10), of which 40% are empirical studies (n=4). In 81% (n=44) of the articles, the first author is affiliated with an American or British institution (resp. 65%; n=35 and 17%; n=9). Overall, 57% of first authors are affiliated only with a military institution (n=31), 4% are affiliated with both a military and civil institution (n=2). Of the papers, 35% are published in military journals (n=19).

EMC phases and areas of cooperation

Table 1 shows the attribution of papers per EMC phase. The recovery phase is featured in only one paper, receiving the least coverage. Four papers cover multiple EMC phases.^{1 7 19 20} The described areas of cooperation were derived from the papers, as shown in table 2. Throughout the EMC, eight areas of cooperation were identified. For the recovery phase, no specific area of cooperation was identified. Both in the preparedness and readiness phases, laboratory surveillance activities were mentioned frequently. Distinctions were made based on actual support in building a surveillance system during the preparedness phase and cooperation within a current real-time surveillance system during the readiness phase.

Recurring themes

Recurring themes on challenges and opportunities in CMC were found in the EMC phases by means of an inductive, iterative process. Five themes were identified: managing relations, framework conditions, integrating collective activities, governance and civil-military differences (table 3).

Managing relations covers the elements that influence the quality and sustainability of relations between cooperating civil and military stakeholders. Framework conditions cover basic requirements enabling CMC, such as funding, legal aspects and agreements, and the availability of military assets. Integrating collective activities identifies challenges and opportunities of sharing knowledge, expertise and data in collaborative activities. Governance encompasses the overarching objective of management and control of cooperation between stakeholders. Civil-military differences includes cultural differences between CMC stakeholders. The next section of this paper outlines what these recurring themes represent per EMC phase.

Recurring themes per EMC phase

Prevention phase

Managing relations

Papers show that long-term commitment is crucial for successful civil-military partnerships in the prevention phase. Authors repeatedly stress that reliable and trusted long-term stakeholder involvement is necessary.²¹⁻²⁴



Table 1 Baseline characteristics and EMC phase

First author	Year	Journal	civ/mil	Affiliated institute* civ/mil	Affiliated institute* home based	Study design	Prevention	Preparedness	Readiness	Response	Recovery
Baxter ⁴⁰	2013	Mil	Civ†	USA	USA	Original research			X		
Blazes ⁴⁸	2013	Mil	Mil	USA	USA	Review of activities			X		
Blazes ⁵²	2011	Civ	Mil	USA	USA	Expert opinion			X		
Bricknell ⁵⁶	2016	Mil	Mil	GBR	GBR	Review of activities				X	
Burke ⁵³	2012	Civ	Mil	USA	USA	Review of activities			X		
Burke ⁵¹	2011	Civ	Mil	USA	USA	Review of activities			X		
Chretien ⁴⁶	2007	Civ	Mil	USA	USA	Expert opinion			X		
Chretien ⁴⁷	2006	Mil	Mil	USA	USA	Review of activities			X		
Clarke ²	2020	Civ	Mil	USA‡	USA‡	Expert opinion				X	
Clay ⁷⁰	2016	Mil	Mil	GBR	GBR	Expert opinion				X	
Diehl ⁵⁷	2016	Civ	Mil	USA	USA	Original research				X	
DiGiovanni ³⁰	2005	Civ	Mil	USA	USA	Review of activities		X			
Ear ⁵⁰	2014	Civ	Mil	USA	USA	Expert opinion			X		
Eardley ⁵⁸	2016	Mil	Civ/mil§	GBR	GBR	Review of activities				X	
Fekadu ²⁸	2016	Civ	Civ	AGO¶	AGO¶	Review of activities	X				
Forestier ⁶²	2016	Mil	Mil	CAN	CAN	Expert opinion**				X	
Forshey ³⁸	2021	Civ	Mil	USA	USA	Original research		X			
France ⁶³	2021	Mil	Civ	GBR	GBR	Original research				X	
Francis ²⁶	1960	Civ	Civ	USA	USA	Expert opinion	X				
Gibbons ²¹	2013	Civ	Mil	USA††	USA††	Review of activities	X				
Gibson-Fall ¹⁹	2021	Civ	Civ	GBR	GBR	Original research	X	X		X	
Harman ⁷¹	2018	Civ	Civ	GBR	GBR	Expert opinion‡‡				X	
Hoyt ²⁷	2006	Civ	Civ	USA	USA	Review of activities	X				
Johns ⁴¹	2010	Civ	Mil	USA	USA	Review of activities			X		
Kamradt-Scott ⁶⁴	2016	Civ	Civ	AUS	AUS	Expert opinion§§				X	
Kohn ³⁹	2010	Civ	Civ	USA	USA	Expert opinion		X			
Liyanage ²⁵	2019	Civ	Civ	LKA-SWE§	LKA-SWE§	Original research¶¶	X				
Lu ⁶⁵	2016	Mil	Mil	CHN	CHN	Review of activities				X	
Ma ³⁶	2016	Mil	Mil	CHN	CHN	Expert opinion		X			
Marres ⁴²	2009	Civ	Civ	NLD	NLD	Review of activities			X		
Maxwell ²²	2008	Mil	Civ†	USA	USA	Review of activities	X				
McGee ⁵⁹	2020	Civ	Mil	USA	USA	Review of activities				X	
Meleigy ²⁰	2007	Civ	Civ	EGY	EGY	WHO News article		X			

Continued

Table 1 Continued

First author	Year	Journal	civ/mil	Affiliated institute* civ/mil	Affiliated institute* home based	Study design	Prevention	Preparedness	Readiness	Response	Recovery
Michaud ¹	2019	Civ	Civ	Civ	USA	Expert opinion	X	X		X	X
Morgan ²³	2003	Civ	Mil	Mil	USA††	Review of activities	X				
Morton Hamel ²⁹	2019	Civ	Civ/mil§	Mil	USA	Review of activities		X			
Naluyima ⁴³	2019	Civ	Mil	Mil	USA	Review of activities***			X		
Nevin ⁶⁷	2016	Civ	Civ	Civ	USA	Original research				X	
Otto ³⁴	2011	Civ	Mil	Mil	USA	Review of activities		X			
Owens ⁴⁴	2009	Civ	Mil	Mil	USA	Review of activities			X		
Reed ⁷²	2015	Civ	Mil	Mil	USA	Review of activities				X	
Ross ⁶⁰	2017	Civ	Civ	Civ	GBR	Original research¶¶				X	
Rustin ⁵⁴	2017	Mil	Civ	Civ	USA	Original research¶¶			X		
Sanchez ³⁵	2011	Civ	Mil	Mil	USA	Review of activities		X			
Snyder ³¹	2009	Mil	Mil	Mil	USA	Expert opinion		X			
Sueker ⁴⁹	2010	Civ	Mil	Mil	USA	Review of activities			X		
Tallowin ⁶¹	2021	Civ	Mil	Mil	GBR	Review of activities				X	
von Bertele ⁶⁶	2016	Mil	Civ	Civ	GBR	Expert opinion				X	
Watterson ⁷	2016	Mil	Civ	Civ	AUS	Expert opinion	X			X	
Wignjadiputro ³²	2020	Civ	Civ	Civ	IDN	Original research¶¶		X			
Williams ⁵⁵	1997	Mil	Civ†	Civ†	USA	Review of activities			X		
Writer ³³	2003	Mil	Mil	Mil	USA	Review of activities		X			
Yingst ⁴⁵	2007	Mil	Mil	Mil	USA	Review of activities			X		
Zottig ²⁴	2020	Mil	Mil	Mil	USA	Review of activities	X				
Total							11	13	18	19	1

Original research: systematic analysis of available information. Review of activities: description of phenomenon or activities without systematic analysis. Expert opinion: normative article, outlining views of author(s). News article: item on current or recent news of either general interest or of a specific topic.

*Affiliated institute of first author.

†Author identifies with military rank.

‡George C. Marshall European Center for International Security Studies, Germany.

§Affiliated on both.

¶WHO Country Representative Office.

‡Based on preliminary distillation of formalised interviews.

††Armed Forces Research Institute of Medical Science, Thailand.

‡‡The findings drawn from literature review on Ebola, policy analysis of WHO and Medécins Sans Frontières (MSF) reports and semi-structured interviews actors involved in the Ebola response.

§§Referring to more than 70 semi-structured interviews.

¶¶Empiric research.

****Makerere University Walter Reed Project, Uganda.

EMC, emergency management cycle.

Table 2 Areas of medical civil–military cooperation per EMC phase

EMC phase	Areas of cooperation
Prevention	Research and development (8x) ^{1 7 19 21 23 24 26 27} Field campaigns (4x) ^{19 22 25 28}
Preparedness	Preparedness plans (4x) ^{31 36 38 39} Capacity building (7x) ^{1 19 20 29 33–35} Exercise/simulation (2x) ^{30 32}
Readiness	Surveillance/laboratorial activities (17x) ^{7 20 40 41 43–55} Major incident hospital (1x) ⁴²
Response	Supporting the civil healthcare system (19x) ^{1 2 7 19 56–67 70–72}
Recovery	No area of cooperation described

EMC, emergency management cycle.

Building relations can be challenging because it ultimately requires high-level political commitment.^{23 25} Still, even when commitment is present, high personnel turnover in especially the military can jeopardise progress.^{23 24} Mutual benefits from a cooperative activity stimulate relations because profits are expected to be gained on both sides.^{1 19 21 23 26} For example, results from research and development (R&D) activities benefit both civilians and soldiers, since militaries will often be a lead product user.^{21 23 26 27} R&D success needs clearly defined development goals and priorities.^{23 24 27} Yet, in the literature, challenges are also put forward due to the opposing R&D goals pursued by civil and military stakeholders. Civil stakeholders might focus on the risks of military involvement, while militaries tend to legitimate military strategic goals through global health engagement.¹⁹

Integrating collective activities

One important strength of civil–military collaboration lies in combining civilian scientific knowledge and military practical knowledge.^{7 21 23 26 27} The 1918 influenza pandemic also hit the US military hard. In 1941, this led to the establishment of commissions involving civilian scientists and industries to control acute epidemic diseases in the US army. Combining their knowledge and the military's extensive experience on outbreak morbidity and recordkeeping resulted in achievements such as the first influenza vaccine.^{7 26 27} However, when armed forces classify data, because of operational considerations, research is severely hampered.¹⁹

Framework conditions

Military funding is a framework condition that offers opportunities for cooperation,¹ yet at the same time is vulnerable to disruptions as military ambitions and strategies may change quickly, redirecting military financial resources.^{1 23}

Civil–military differences

Using military personnel during vaccination campaigns is considered effective due to their decisive attitude and communication, while at the same time this could be perceived as mandatory or even suppressive.^{19 28}

Preparedness phase

Managing relations

Civil–military capacity building projects are challenged by high military personnel turnover rates,²⁹ and stakeholders in preparedness exercises struggle with their own competing organisational priorities.^{30–32} It is mentioned again that successful cooperation requires early involvement of stakeholders as well as reliable long-term commitments.^{29 30 32 33} However, in low-income and middle-income countries, international military assistance in capacity building can be suspected of political or security motives, to the extent that improving the local healthcare system is believed to serve primarily the strengthening of international relationships and foreign military strategy and capacities.^{1 19 29 33 34} Obviously, such practices, especially when hampered by short-term interventions, hold the risk of causing tensions and distrust.^{1 19} To gain trust among cooperating stakeholders, transparency on data ownership and data sharing from all stakeholders are required.³⁵

Framework conditions

National medical military involvement in emergency responses should be consistent with national and military law and regulations,^{31 36} and can be arranged in joint preparedness plans to provide a solid institutional foundation.³⁶ Ongoing planning, exercising and capacity building activities require binding civil–military agreements for all civil and military stakeholders involved.^{30 31 34 35} Yet, regarding the International Health Regulations notification agreements (IHR 2005),³⁷ this can jeopardise operational security and might be a reason for military troops not to comply.³⁸ Legal restrictions or reluctance of civil stakeholders towards civil funding of military engaged projects can also limit military involvement in global health security activities.³⁸ On the other hand, military financial flows provide an opportunity for bolstering civil–military capacity building programmes.^{34 35} However, programme discontinuity due to lack of money or inconsistent funding remains challenging,^{29 34 35} as insufficient funding is for effective preparedness planning and exercising.³¹ In relation to

Table 3 Recurring themes

Articles per recurring theme (n)					
EMC phase	Managing relations	Framework conditions	Integrating collective activities	Governance	Civil–military differences
Prevention	9 ^{1 19 21–23 25–27 35}	3 ^{1 23 28}	6 ^{7 19 21 23 26 27}	0	2 ^{19 28}
Preparedness	9 ^{1 19 29–35}	8 ^{29–31 34–36 38 39}	7 ^{1 20 32 34–36 38}	7 ^{29 31 32 34–36 39}	2 ^{34 39}
Readiness	15 ^{20 40–50 52 53}	13 ^{20 40–42 45 47–54}	16 ^{7 40 43–49 51–55}	1 ⁵⁴	1 ⁴⁵
Response	8 ^{1 56–62}	15 ^{1 2 7 19 56 57 59 61–67 70}	4 ^{1 59 63 67}	8 ^{1 2 57 60 62–64 71}	13 ^{1 57–62 64–67 71 72}
Recovery	0	1 ¹	0	0	0
Total	41	40	33	16	18
EMC, emergency management cycle.					

preparedness plans, opportunities for accessible military capacity are mentioned in two papers.^{38 39} Although armed forces are seen as self-sustaining and holding relevant expertise on command and control, as well as being able to rapidly deploy trained personnel,^{38 39} the importance to adhere to already dedicated resources of civil agencies, except under extreme scenarios, is clearly argued.³⁹ This is in line with the UN Office for the Coordination of Humanitarian Affairs (UNOCHA) policy for defence as a last resort option.

Integrating collective activities

The value of sharing knowledge, expertise and data is recognised across civil–military capacity building activities,^{20 34 35} joint preparedness plans³⁶ and as the conclusion from a full-scale pandemic simulation.³² Effective information-sharing requires civil–military integration and standardisation to ensure that plans and mechanisms can be implemented in practice.^{32 35 36} As of yet, military activities and plans do not always integrate into civil response plans, making them less useful.^{1 32} This is in accordance with the finding that incorporation of military involvement in WHO Joint External Evaluations and National Actions Plans for Health Security is limited.³⁸ It is therefore critical to involve the defence sector at an early stage of national and local preparedness plans.^{31 39}

Governance

More coordination is required within both military and civil agencies performing similar work.^{29 34 35} Some authors promote unified command in CMC for planning and exercises.^{32 36}

Civil–military differences

Regarding the preparedness phase, Kohn *et al*³⁹ emphasise the benefits of military culture in preparing for response: ‘They are task oriented (...), and practiced at multitasking under difficult conditions. (...) trained to perform duties independent of their personal wishes and even in the face of inherent dangers’.³⁹ Yet, language barriers appear as a practical challenge in international capacity building projects.³⁴

Readiness phase

Managing relations

As mentioned previously, long-term stakeholder commitment is emphasised,^{40–45} and the role of a military liaison within civil agencies may be helpful.^{44 46 47} Several authors believe that cooperation in disease surveillance is a constructive way for the military to engage with developing partner countries to improve their capacity to detect and respond to outbreaks.^{20 40 41 45 46 48 49} In practise, however, this may turn out differently. Referring to the closing of a US Navy overseas laboratory in Indonesia in 2010 after diplomatic tensions, the author reports host–donor problems.⁵⁰ This is a sensitive subject in cooperation, requiring local awareness.^{50 51} To avoid incidents, transparency and building trust among partners is advised.^{45 52 53}

Framework conditions

In case of infectious disease outbreaks, the belief in the advantages of rapid reaction, as would be realised by cooperation with the military, appears widespread.^{20 41 42 45 47 51 54} Although military funding can indeed support cooperation,^{40 41 47 49 51 54} it remains less reliable due to fiscal constraints, while a discussion on expenditures and cost-effectiveness often is lagging or absent altogether.^{40 48} The above-mentioned closing of a Navy laboratory in Indonesia also shows that formal agreements can be a boundary condition to collaboration. Legal aspects of partner nations' sovereignty of data (eg, who owns the collected data and has mandate to act accordingly) are frequently discussed,^{48–50 52 53} and resemble challenges in establishing data-sharing agreements.^{48 49}

Integrating collective activities

US military laboratories add value to surveillance mainly through the DoD's GEIS network. Next, to collecting seed strains for vaccine development and assessments of safety and effectiveness of vaccines, GEIS fills gaps in WHO and CDC surveillance systems, especially in remote settings, as it offers rapid identification of outbreaks.^{40 41 44–49 51–55} As indicated before, such collective actions benefit from standardisation of approaches. This also remains challenging during the readiness phase.^{48 51} A representative readiness example, from a US DoD project in Uganda, aims to enable readiness for laboratory outbreak response and clinical research readiness and is fully embedded in the national response framework.⁴³ Another example is the establishment of a major incident hospital,⁴² which integrates civil–military capabilities and expertise in disaster response, including outbreaks, into one medical facility that can be activated at any time.

Governance

One paper points out difficulties in governance during the readiness phase due to the absence of one central coordinating agency.⁵⁴

Civil–military differences

Regarding global influenza surveillance, one author states that the military is the more suitable organisation for execution, because of potential risks involved: 'it is important to have people with a soldier's mindset, commitment, drive and sense of duty to accomplish what must be done'.⁴⁵

Response phase

Managing relations

Again, some good practices are identified that are crucial components of successful CMC. These include pre-existing relationships, early involvement of stakeholders and the use of liaisons to improve mutual trust and support for programmes.^{56–61} For example, during the West African Ebola crisis, the UK military training programme on the use of personal protective equipment was initiated with early engagement of local staff and

handed over to a non-governmental organisation for a more long-term and sustainable execution.⁵⁶ Again, high military turnover rates are viewed as problematic, leading to a loss of knowledge.⁶²

Framework conditions

Authors emphasise the military's ability to rapidly plan and organise military medical capabilities,^{1 2 7 56 57 59–65} and to deploy under austere and challenging circumstances.^{1 56 66} During the West African Ebola crisis, these military characteristics worked as a catalyst to the international community and boosted morale.^{1 56 61 62 64 66 67} Contrary to expectations, a slow initial response by US troops has been observed as well.^{64 67} Additionally, engagement in civil assistance might take its toll by negatively impacting the readiness of military troops for their primary tasks.^{2 19} Regarding funding, deployment funding comes from a military budget, which is not earmarked for disaster response or humanitarian assistance, hampering funding transparency and a clear understanding of cost-effectiveness of a military versus a civil response.¹ When it comes to regulations in civil–military response collaboration, UNOCHA Oslo guidelines and Military and Civil Defence Assets guidelines,^{68 69} as well as the military rules of engagement, play an important role. However, civilian and military actors remain unaware, which may cause frustration and reputational damage.^{1 56 57 62 64 66 70} Gibson-Fall¹⁹ argues that the COVID-19 pandemic demonstrates the need for new civil and military domestic legal and ethical frameworks and instruments. Involving the military in public health protective activities, which include restrictions for the population, requires a delicate balance between human rights and public health protection.¹⁹

Integrating collective activities

Loss of knowledge by high personnel turnover rates constituted a particular problem during the Ebola crisis, as there was already a lack in training key skills and knowledge.^{1 63 67} During the COVID-19 outbreak, instead, medical military activities merged into effective and safe civil–military operations by communicating and adopting best practices in dialogue with local civilian healthcare representatives.⁵⁹

Governance

The framing of an outbreak affects the response and its governance. Framing Ebola as a health crisis instead of humanitarian crisis caused confusion. Neither WHO (coordinating health emergencies) or UNOCHA (humanitarian crisis coordination), but the newly established UN Mission for Ebola Emergency Response (UNMEER) had to coordinate the response. This appointment resulted in ad-hoc, untried arrangements and uncertainty among responding agencies and deployed military troops,^{60 62 64 71} in the absence of a framework on how (inter)national militaries operate in these situations.^{63 64} Notwithstanding, the praised military advantages regarding operational planning, coordination,

command and control,^{1 2 60 62} stakeholders faced poor coordination due to differing reporting requirements and mechanisms, mission planning, and mandates and operating in information siloes.^{57 60 62} These problems appear similar to the ones mentioned in integrating collective activities.

Civil–military differences

During the West African Ebola crisis, this theme was frequently addressed. Despite being trained to work in challenging contexts, military risk aversion and inflexibility on mission objectives has been frequently observed.^{1 64 66 67 71} Furthermore, language barriers, including the use of operational terminology, can create challenges in communication,^{57 58 65 72} as do differences in organisational cultures regarding authority, backgrounds and interests.^{57 60–62} The directness of military personnel does not remedy this situation,^{58 62 64} but instead, has resulted in growing aversion among civilian agencies.⁶²

Recovery phase

In one paper, a recurring theme for this phase was identified, but was formulated in general terms and did not refer to a specific area of cooperation.

Framework conditions

Even though there are more complex and lasting emergencies, existing UN guidelines ‘do not provide strategy and guidance on how the military can best interface with other actors (...) to contribute to longer-term recovery and resilience efforts’.¹

DISCUSSION

This review captured insights on the breadth and dynamics regarding CMC in the management of infectious disease outbreaks. The underlying patterns of challenges and opportunities show that successful cooperation needs sustainable relations, binding agreements, transparency, a clear operational perspective and acknowledgement of organisational cultural differences. This review shows that military involvement can boost projects, campaigns and emergency responses. However, the challenge is to avoid distrust and tension among stakeholders because healthcare engagement is not the military’s primary task. Moreover, the military might strive for different strategic goals than civil stakeholders in healthcare.

The absence of binding agreements or unfamiliarity with applied (inter)national agreements, seen at operational/tactical level, may be grounds for miscommunication, frustration and poor use of resources. Furthermore, high turnover rates necessitate people being continuously informed on the regulations in force. Advantages can be gained in education and training on relevant (inter)national regulations for all personnel involved in the civil–military collaborations, and by investing in binding agreements derived from mutual developed plans. Using liaisons to facilitate collaboration and

establish preoutbreak relations across key stakeholder organisations appears promising.

An interesting discrepancy is found regarding the often praised decisive military appearance. Despite expectations of a bold military attitude during the response to the Ebola crisis in West Africa, military risk-averse behaviour was perceived. In a study of Draper and Jenkins⁷³ some deployed militaries state that ‘they had not ‘signed up for’ these particular (Ebola) risks’. More often, it is suggested that the top military command wanted to minimise infection risk.⁷³ This can possibly be explained by the political aspect of military deployment. Acceptance for military casualties is more generally declining.⁷⁴ Political high-level commitment for military engagement in outbreak response is therefore conditional. The Ebola crisis also showed that the perspective from which a crisis is handled is crucial for the way the response is executed, subsequently guiding the (potential) role for the military. If there is a role, mutual civil and military expectations should be settled on the crisis perspective so armed forces and civil stakeholders can prepare and respond accordingly. All this needs to be supported by transparent information sharing, despite the military’s habit to work with classified information and civilian reluctance to share information with militaries.⁷⁵

Identified literature gaps and future research priorities

In the screening process of our literature search, we excluded many articles stating important military contributions by listing military activities and achievements beneficial to the military and civil populations alike, without analysing the civil–military process of cooperation. The relatively small number of papers that provide an analysis on civil–military collaboration suggest this is an understudied research topic. The lack of original research limits the quality of current scientific knowledge, making well-founded considerations on military involvement in support of civilian stakeholders more difficult. Moreover, the peer-reviewed literature on this topic is dominated by American and British military scholars and, as such, does little justice to the full scope and diversity of global CMC efforts in health. Overall, this review, showing current research, concludes there is insufficient in-depth and comprehensive understanding of civil–military collaboration dynamics for the management of infectious disease outbreaks.

The lack of research papers related to the EMC recovery phase show that further analysis on this literature gap is justified. Furthermore, few articles are published that study cooperation during exercises. The military is familiar with performing exercises and this might be an underused military skill providing opportunities for cooperative exercises, especially when results are published to learn from.⁷⁶

Table 2 shows the CMC activities, although there may be differences between collaboration dynamics and challenges within EMC phases depending on the activity. For instance, during prevention, CMC for R&D purposes

and field campaigns might face different demands and dilemmas.

The identified recurring themes reflect the dynamics in CMC, but it is equally important to know the impact of cooperation. Among other objectives, Michaud mentions in his seminal paper that it is important to ensure that military engagement is effective. It has already been observed that research on this topic is lacking.^{19 40 77} This means that we do not know whether cooperation results in effective involvement of the military in outbreak management. Performance measurement, such as evaluation of preset goals, can help to optimise military (and civilian) involvement in all stages of the EMC. COVID-19 initiates multiple pandemic preparedness initiatives, providing opportunities to incorporate the military. Action research during planning and exercises can lead to evidence-based policy decisions. Moreover, the military becomes a more significant stakeholder in the outbreak management network. Keeping in mind the potential asymmetry between stakeholders' institutional goals, it is interesting to explore the military's role within this network. For this, the five identified themes provide a strong starting point.

This review included studies on domestic and international CMC. Most of the papers on domestic cooperation were attributed to the prevention and preparedness phase, while studies on international cooperation dominated the readiness and response phases. This may change in the upcoming years as research on domestic CMC during the COVID-19 outbreak finds its way into the academic discourse. It provides grounds to analyse contextual differences between domestic and international activities. Furthermore, the impact of a domestically dominated approach to a transnational security threat, and the role of the military in such an approach, might come to light.

In general, the outcomes of this review offer a solid base for further research that can strengthen future civil–military collaboration, improve their outcomes and enhance the collaborative management of infectious disease outbreaks.

Strengths and limitations

To our knowledge, this is the first review systematically outlining peer-reviewed literature from the rather fragmented field of medical civil–military collaboration in managing outbreaks. It seems timely to conduct this review during an ongoing pandemic, in which preparations and planning for next outbreaks take place. This review provides suggestions for more successful cooperation when militaries are involved. As a scoping review implies, papers are not selected on study design for highest level of evidence, implying limited 'weight' of evidence. The review excludes books, grey literature and institutional reports, sources that might provide even more in depth information on this topic.

CONCLUSION

The WHO aims to break the cycle of 'panic and forget' in outbreak response by investing in multistakeholder

approaches, including the military, into all phases of the EMC.¹¹ Still, 'the key question is not whether militaries should be involved in global health', including outbreaks, 'but rather how to ensure military engagement is appropriate, constructive, effective and coordinated with other actors'.¹ We systematically analysed peer-reviewed scientific literature on civil–military collaboration. This approach revealed current challenges and opportunities while emphasising the priority for more research to understand how this collaboration can be reshaped in anticipation of future infectious disease emergencies. Early and continuous engagement in pandemic and non-pandemic times turns out to be crucial for navigating differences in approach, cultures and mutual expectations.

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