Identifying the sectors involved in the European public health emergency preparedness and response: a systematic review

L S Kengne Kamga,1,2 A C G Voordouw,3 M C de Vries,3 E Belfroid,1 M Koopmans,4 A Timen1,2

ABSTRACT

Objectives A systematic review was conducted with the aims of identifying sectors mentioned in the public health emergency preparedness and response (PHEPR) literature and mapping the involvement of those sectors in the seven PHEPR cycle domains.

Setting A detailed search strategy was conducted in Embase and Scopus, covering the period between 1 January 2005 and 1 January 2020.

Methods Published articles focusing on preparedness for and/or response to public health emergencies of multiple origins on the European continent were included. The frequency with which predetermined sectors were mentioned when describing collaboration during the preparedness and response cycle was determined.

Results The results show that description of the involvement of sectors in PHEPR in general and collaboration during PHEPR is predominantly confined to a limited number of sectors, namely ‘Governmental institutions’, ‘Human health industry’, ‘Experts’ and ‘Civil Society’. Description is also limited to only three domains of the PHEPR cycle, namely ‘Risk and crisis management’, ‘Pre-event preparations and governance’ and ‘Surveillance’.

Conclusions Optimal preparedness and response require predefined collaboration with a broader scope of partners than currently seems to be the case based on this literature review. We recommend considering these outcomes when planning multisectoral collaboration during preparedness and response, as well as the need to further operationalise the term ‘multisectoral collaboration’ during PHEPRs.

PROSPERO registration number PROSPERO with registration number 176331.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The search was limited to the Embase and Scopus databases, which yielded a high number of included articles; however it is uncertain whether the representation of all the origins of public health emergencies were proportionately represented.

⇒ The list of sectors used is comprehensive and considerate of all aspects of society.

⇒ We provide a systematic assessment of the actual implementation of the recommended ‘multisectoral collaboration’ as defined in the International Health Regulations, based on review of peer-reviewed literature.

INTRODUCTION

The COVID-19 pandemic will go down in the books as one of the most comprehensive and defining crises in modern history. Since January 2020, this crisis has spread across the world and, at the time of writing (February, 2022), has resulted in nearly 400 million confirmed cases and close to 6 million notified deaths worldwide.1 For a large part of the crisis, governments around the world were overwhelmed by the high infection and death rates. Both the spread of the virus and the stringent control measures implemented in response to the pandemic have affected many aspects of society. To name some examples, action was required from different healthcare and governmental organisations within healthcare and governmental sectors to deal with identification, isolation and—if necessary—treatment of COVID-19 patients. At the same time, efforts were required from different organisations to help society navigate life with the stringent control measures implemented.

It is fair to say public health emergency preparedness and response (PHEPR) experts have been overwhelmed by the extent of multisectoral collaboration needed during the COVID-19 pandemic. This is despite the existence of (1) The International Health Regulations (IHR) (2005) and the European Union’s (EU) Decision 1082/2013,23 and (2) Governance literature,44 which all encourage multisectoral collaboration in such contexts. Scholars have described the need for governments to engage in multisectoral collaboration in order to increase, among others, the
democratic legitimacy of decision-making processes, the contextual appropriateness of decisions made, as well as the general acceptability and support for the decisions made.6–8

However, in the IHR and EU decision 1082/2013, the concept ‘multisectoral collaboration’, has only been broadly defined. The documents do not specify which sectors should be involved, the desired timing of their involvement or their task divisions. Furthermore, although both documents embrace an all-hazard approach and encourage the development of generic preparedness and response plans, there is limited practical information on what this means for multisectoral collaboration. There are also no publicly available European overviews of the practice of multisectoral collaboration, with information such as one would expect from national and subnational PHEPR evaluations. Lastly, to our knowledge, no international legal agreements, published guidelines or systematic studies provide this information.

Hence, in order to have a first overview of the available knowledge on sector involvement in the literature published before the onset of the COVID-19 pandemic, we conducted a systematic review to (1) Identify the broad sectors mentioned most frequently in peer-reviewed literature on PHEPR, and (2) Map the involvement of different sectors in the seven PHEPR cycle domains.

**METHODS**

This systematic review will be reported using the Preferred Reporting Items for Systematic Reviews and Meta-analyses framework. The original review protocol was submitted to PROSPERO with receipt number 176331.

**Search strategy**

A detailed search strategy was conducted in two electronic databases, namely Embase (Elsevier, Amsterdam, The Netherlands) and Scopus (Elsevier, Amsterdam, The Netherlands) in March 2020, covering the period between 1 January 2005, the year the latest revision of the International Health Regulations (IHR) 2005 was adopted, and 1 January 2020. A combination of non-Medical Subject Heading terms referring to four concepts, namely ‘public health emergencies’, ‘collaboration’, ‘preparedness’ and ‘response’, were used. The complete search strategy can be found in the online supplemental file 1.

**Article screening and data extraction**

Papers retrieved through the literature search were entered in an EndNote V.20 library (Clarivate Analytics, USA) and duplicates were removed. Prior to formal screening, the review team members ACGV and LSKK piloted the inclusion and exclusion criteria by screening and discussing the titles and abstracts of 10% of the articles. They also later conducted the formal screening process at the title, abstract and full-text levels. Articles focusing on preparedness for and/or response to public health emergencies of biological, chemical, radio nuclear or environmental origins affecting human health on the European continent were included. Articles focusing on emergencies of other origins, or on technical aspects of preparedness and response, like laboratory techniques and vaccine manufacturing, were excluded. A full description of the screening and the final inclusion and exclusion criteria is provided in the online supplemental file 2.

During the extraction process, first, the organisations mentioned in the articles were identified and grouped into sectors based on the European Commission’s list of sectors and economic activities.9 The sectors on this list are broad, which allows the list to be comprehensive and to consider all aspects of society, including sectors (and their corresponding organisations) which may not be obvious when making preparedness and response plans. Some modifications were made to the list to accommodate all sectors mentioned in the literature (online supplemental file 2). Second, the frequency with which sectors were mentioned when describing collaboration during preparedness and response was determined. The focus was on passages containing the words cooperation, coordination, collaboration and/or data or information exchange, regardless of possible interpretations of the words based on previous governance literature.10 Lastly, it was identified which domains of preparedness and response were being described when mentioning the involvement of different organisations. The results were classified according to the seven domains of the preparedness and response process, namely (1) Pre-event preparations and governance, (2) Capacity building and maintenance, (3) Surveillance, (4) Risk assessment, (5) Risk and crisis management, (6) Post-event evaluation, and (7) Implementation of lessons learnt, as described by Belfroid et al.11

A quality assessment of the articles was not performed, as this study did not focus on the included articles’ outcomes, but aimed rather to assess the range of sectors mentioned, independent of study outcome.

**Public and patient involvement**

The aim of this systematic review was to identify relevant sectors; hence we did not involve ‘the public’ within this study.

**Ethics approval**

Not applicable as no human participants or animal subjects were included.

**RESULTS**

**Database searches and results**

A total of 4047 articles was identified, of which 3769 titles and abstracts were reviewed after the duplicates (n=278) were removed. One thousand two hundred and six individual articles were screened at the full-text stage and 94 articles were included. Figure 1 shows the screening process and results. Online supplemental file 3 provides an overview of the included articles.
ARTICLE CHARACTERISTICS

Of the 94 included articles, 52 articles (55%) were published in or before 2013, the year the European Decision 1082/2013 was implemented. Fifty (53%) articles focused on public health emergencies of biological origin, 10 (11%) on public health emergencies of radio-nuclear origin, 6 (6%) on public health emergencies of chemical origin, 4 (4%) on public health emergencies of environmental origin and 24 (26%) articles focused on single or multiple complex public health emergencies (PHEs) of different or multiple origins.

The sectors involved in PHEPR

The inventory found 6858 mentions of organisations that could be attributed to 19 of the 28 sectors. Of these, 5868 (85%) were attributed to four sectors, namely ‘Governmental institutions’ (n=3042, 44%), ‘Human health industries’ (n=1527, 22%), ‘Experts’ (n=696, 10%) and ‘Civil society’ (n=603, 9%). Fourteen sectors were mentioned less than 10 times when describing preparedness and response and nine sectors were not mentioned at all.

When looking specifically at passages describing cooperation, coordination, collaboration or data sharing (jointly described as ‘collaboration’ from here on) during PHEPR, there were 1069 mentions of organisation. This is 16% of the total number of mentions (n=6858). Of these 1069 mentions, over 90% were attributed to the four sectors ‘Governmental institutions’ (n=674, 63%), ‘Human health industries’ (n=175, 16%), ‘Experts’ (n=82, 8%) and ‘Civil society’ (n=55, 5%), as shown in figure 2. Please refer to the online supplemental file 2 for more information on the categorisation of the sectors.

Collaborations mentioned in the articles either referred to collaborations that were in place in past PHEPR or collaborations that the articles’ authors recommended. There was no major difference in the frequency of sectors mentioned in these two situations, except for description of the role of ‘civil society’, with 2% of mentions in retrospective data, 8% of mentions as suggestions for involvement in future PHEPR.

Collaboration within the domains of the PHEPR cycle

Lastly, the collaborations were mapped across the public health preparedness and response (PHEPR) cycle (figure 3). Of the sector mentions when describing collaboration, 94% (n=1002) described specific PHEPR domains. They were mentioned most often when describing the domains ‘Risk and crisis management’, ‘Pre-event preparations and governance’ and ‘Surveillance’, and least often when describing the domains ‘Lessons learnt’, ‘Capacity building and maintenance’ and ‘Post event evaluation’.

The four sectors that were mentioned most frequently when describing collaboration in general (namely ‘Governmental institutions’, ‘Human Health’, ‘Experts’ and ‘Civil Society’) were also mentioned across multiple preparedness and response domains. Only a handful of sectors were mentioned when describing the other domains.

DISCUSSION

The aim of this systematic review was to assess how multi-sectoral collaboration currently has been implemented in the PHEPR cycle, as documented by published literature. The results show that, within the European context, description of multi-sectoral involvement is predominantly confined to a very limited number of sectors and to three domains of the PHEPR cycle.

The dominance of mentions of the sector ‘Governmental institutions’ is as expected given the Member State is ultimately responsible for the management of public health emergencies. In addition, this category also included international organisations such as the WHO and the EU. The WHO is mandated to coordinate PHEPR; it pools information as well as disseminates advice and guidance. Similarly, the EU and its institutions, such as the European Centre for Disease Prevention and Control, aims to coordinate and strengthen
Europe’s defence against, and reaction to, public health emergencies.13

The second most frequently mentioned sector was the ‘Human health industry’, which is rather obvious given our focus on public health emergencies, and because healthcare is a key stakeholder during health emergencies. It is therefore remarkable that they were rarely mentioned in certain domains of the PHEPR cycle such as (1) Risk assessment, (2) Capacity building and maintenance, (3) Post-event evaluation, and (4) Lessons learnt. During the COVID-19 pandemic, hospitals were rapidly overburdened and public health action was taken by governmental institutions to reduce the impact on the healthcare sector, among others. Therefore, a clear recommendation for the sectors ‘Governmental institutions’ and ‘Human health industry’ is to develop joint PHEPR action plans to prepare for future pandemics and other threats, with specific attention to all the domains of the PHEPR cycle.

Regarding the third most frequently mentioned sector, ‘Experts’, Rosenthal et al.14 have stated that expertise and advisory capacity are determining factors for the quality of the decision-making process. In a crisis, decision makers are often constrained by high levels of uncertainty due to a lack of informational quantity and quality. This a result of incomplete information, the presence of ambiguous information, and/or the availability of conflicting information.15 In these situations, governments employ experts to anticipate and develop adequate response.16 It is therefore remarkable to observe the low frequency of mentioning experts in some of the PHEPR steps, particularly in the evaluative domains.

The fourth sector named most frequently was ‘Civil society’. Particularly interesting is that this sector is mentioned more often as ‘should be involved’ than ‘actively involved’. This suggests that this sector’s involvement in preparedness and response is at least acknowledged, but not effectuated. There is considerable literature that advocates for community engagement when dealing with emergencies. Many ideas stem from literature on ‘good governance’, which focuses on the democratic mechanisms in place with the aim of involving citizens in the public policy-making process.4 6 Within democratic countries, there is an ongoing shift in authorities’ mindsets from serving citizens and treating them as service users to engaging citizens.17 This engagement should, ideally, also include capacity building and incorporation of lessons learnt, to increase societal resilience for future emergencies.

There were not only significant differences in the number of times different sectors were mentioned when describing collaboration during preparedness and response, but there were also significant differences in the frequency with which the collaboration took place within the different PHEPR domains. Although some research suggests that collaboration is required for all aspects of public health emergencies,18 the actual involvement may depend on the complexity of the issue at hand, that is, whether those involved believe there is a high risk level and whether there is a high degree of uncertainty.

**Figure 3** The frequency with which sectors were mentioned when describing the domains of preparedness and response (the sectors that were not mentioned are omitted). The order of the domains and sectors is based on the frequency of mention. This is a heat map, where red shows the lowest values, yellow shows the values in the 50th percentile, and green shows the highest values.
regarding components of the situation.\textsuperscript{19} The degree of uncertainty is dependent on the availability of the information on (1) The characteristics of the situation and (2) How to deal with the situation, as well as on the availability of the resources to deal with situation.\textsuperscript{3 20 21} This study’s results show that multisectoral collaboration has been considered less frequently in the domains ‘Risk assessment’, ‘Capacity building and maintenance’, ‘Post-event evaluation’ and ‘Lessons learnt’—all activities that take place in ‘peace time’ as reflected by the studied literature. Reasons for this can only be speculated at this stage but—given the experience during the COVID-19 pandemic—should be reconsidered. There is a clear risk of blind spots when multisectoral collaboration is only initiated during an acute phase of an event.

Our study exposes the need for better conceptualisation and operationalisation of multisectoral collaboration during PHEPR, and more specifically (1) The proper identification of the potential roles of different sectors in preparedness and response plans, (2) Understanding the added value of including or excluding specific sectors in specific activities, and (3) The acknowledgement of the need to also pay sufficient attention to collaboration during the non-acute domains of the PHEPR cycle.

Strengths and limitations
To our knowledge, this systematic review is the first to provide an overview of the sectors that have been reported to be involved in past PHE. Due to our all-hazard approach, the results can be useful for preparedness and response experts focusing on PHEs of different origins, even if the generalisability is constrained to the European context. It must be kept in mind, however, that PHEs of radio nuclear and environmental origins were less represented in this study as literature on these topics was limited. In total, 55% of the articles included were of biological origin. This seems disproportionally high; however, this is difficult to confirm as the system that records public health emergencies of all origins for all European countries does not provide public access. We therefore cannot assess if our output is biased, and if so, in which direction. Potential biases may result from the choice of databases (Embase and Scopus), and our choice not to include national or regional preparedness documents. This was done given the lack of standardisation (and hence comparability) of such plans. However, we believe that our study provides a starting point for studies focusing on individual European countries, where any other resources can be used.

The COVID-19 pandemic has re-emphasised the importance of multisectoral collaboration but was beyond our inclusion period. We anticipate a future similar systematic review including articles published during the COVID-19 pandemic, in order to compare those results with this study’s results. This will help identify any changes in the understanding of multisectoral collaboration or changes in the focus on certain sectors.

Conclusion
Comprehensive preparedness requires predefined collaboration with a much broader scope of partners than is currently the case. Our paper provides a stepping-stone for mapping the possibly underrepresented or overlooked sectors in preparedness and response planning. The results presented provide those responsible for designing preparedness and response plans with opportunities for reflection and suggestions on the sectors to consider for multisectoral involvement as well as the timing of their involvement considering the Public Health emergency preparedness and response (PHEPR) domains. Given the complex nature of health emergencies, the diversity in possible threat origins and their potentially large societal impact, it is important to increase the scope of partnerships and possible timing of collaboration considered. The results also emphasise the need for further operationalisation of the term ‘multisectoral collaboration’ during PHEPRs.

Author affiliations
1Centre for Infectious Disease Control, National Institute for Public Health and the Environment, Bilthoven, The Netherlands
2Athena Institute for Research on Innovation and Communication in Health and Life Sciences, Vrije Universiteit, Amsterdam, The Netherlands
3Center for Infectious Disease Research, Diagnostics and Laboratory Surveillance, National Institute for Public Health and the Environment, Bilthoven, The Netherlands
4Department of Virology, Erasmus MC, Rotterdam, The Netherlands

Acknowledgements The authors thank R Van Spronken and W Bramer (information specialists).

Contributors LSKK designed the study, conducted the search, screened the search results, extracted the data, and wrote manuscript. ACGV also designed the study, screened the search results, and revised the manuscript. MvdV also designed the study and revised the manuscript. EB also designed the study and conducted the search process. MK and AT also designed the study and revised the manuscript. LSKK, ACGV, MvdV, MK and AT interpreted the data. LSKK, ACGV, MvdV, EB, MK and AT read and approved the final (revised) manuscript. LSKK submitted the study and acts as the guarantor.

Funding This project was funded by European Union Joint Action Sharp (848096 — SHARP JA — HP-JA-2018/HP-JA-2018)

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is

REFERENCES