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Success and challenges of health systems resilience-enhancing strategies for managing Public Health Emergencies of International Concerns (PHEIC): A systematic review protocol

R M Nayani Umesha Rajapaksha,1,2 Resham B Khatri,2 Chhrishantha Abeyesena,3 Millawage Supun Dilara Wijesinghe,4 Aklilu Endalamaw,2,5 Toms K Thomas,6 Nadeeka Perera,1,7 Roshan Rambukwella,1,7 Gayani De Silva,1,7 Mekala Fernando,1,7 Yibeltal Assefa Alemu2

ABSTRACT

Introduction Health systems resilience is the ability to prepare, manage and learn from a sudden and unpredictable extreme change that impacts health systems. Health systems globally have recently been affected by a number of catastrophic events, including natural disasters and infectious disease epidemics. Understanding health systems resilience has never been more essential until emerging global pandemics. Therefore, the application of resilience-enhancing strategies needs to be assessed to identify the management gaps and give valuable recommendations from the lessons learnt from the global pandemic.

Methods The systematic review will be reported using the Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA-P) protocols guideline. Reporting data on World Health Organization (WHO) health system building blocks and systematic searches on resilience enhancing strategies for the management of Public Health Emergencies of International Concerns (PHEIC) after the establishment of International Health Regulations (IHR) in 2007 will be included. The search will be conducted in PubMed, Scopus, Web of Science and Google Scholar.

Ethics and dissemination Ethics approval and safety considerations are not applicable. Pre-print of the protocol is available online, and the screening of the articles will be done using Rayyan software in a transparent manner. The findings will be presented at conferences and the final review’s findings will be published in a peer-reviewed international journal and will be disseminated to global communities for the application of successful management strategies for the management of future pandemics.

PROSPERO registration number CRD42022352612; https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022352612

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The systematic review will be reported using the Preferred Reporting Items for Systematic review and meta-analysis protocols guideline.
⇒ We intend to include all studies in English.
⇒ Resilience-enhancing strategies published in peer-reviewed journals for the management of PHEIC after establishment of IHR will be analysed.
⇒ Collaboration between Asia-Pacific researchers with different backgrounds.
⇒ May not be possible to conduct a meta-analysis due to nature of the selected scope of the research and inclusion of qualitative studies.

INTRODUCTION

Health systems resilience is defined as ‘the ability to prepare, manage and learn from a sudden and unpredictable extreme change which impacts on health systems’. It focuses on the health system preparedness and response to an emergency and coping capacity for changes following a crisis in view of absorbing, adapting and transforming. However, the focus of the health system resilience was broadened with the improving number of literatures around health systems resilience, which extends to focus on vulnerability, system strains and everyday resilience. Understanding health system resilience has never been more essential until emerging global pandemics. Health systems globally have recently been affected by a number of catastrophic events, including natural disasters, infectious disease epidemics such as Ebola outbreak, novel COVID-19 pandemic. Due to the new emergence and rapid transmission of the COVID-19 since late 2019, global health
Health systems are severely affected. As stated by the WHO, all the organisations, institutions, resources and people whose primary purpose is to improve health is included in the health system. Moreover, efforts to influence determinants of health and direct health-improvement activities are considered as the component of the health system. A health system delivers preventive, promotive, curative and rehabilitative interventions combined with public health actions and the pyramid of healthcare facilities that provide personal healthcare by multi-stakeholders. A health system needs human resources, health finances, information, supplies, transport, communications, overall guidance and direction to provide a quality service. Each area of the health system needs to be strengthened to address the key constraints. Therefore, the WHO described six building blocks of the health system framework which include health service delivery, health workforce, health information systems, access to essential medicines/vaccines, health financing, leadership and governance. These building blocks are targeted to achieve impacts, including improved health outcomes, equity, social and financial risk protection, responsiveness, and efficiency, which contribute to strengthening health systems to provide sustainable quality, efficient and effective health services. Furthermore, the need for understanding of governing of health systems is highlighted following catastrophic events occurring over the last decade. The majority of low and middle-income countries were highly affected by the emergence of infectious diseases (eg, Ebola, COVID-19) and armed conflicts. Moreover, managing the crises, national responses across the globe were varied, some focus on the transmission of diseases and prevention of deaths. Importantly, the countries having established good health systems also struggled to cope with the exponentially accelerating number of cases. With the exponential increase of pandemics, the International Health Regulations (IHR) was established in 2007 for governing the global health security. The IHR declared Public Health Emergencies of International Concern (PHEIC). Six events of PHEIC were documented between 2007 and 2020, including ‘H1N1 influenza pandemic (2009), Ebola (West African outbreak 2013–2015, outbreak in Democratic Republic of Congo 2018–2020), poliomyelitis (2014 to present), Zika (2016) and COVID-19 (2020 to present)’. Among them Poliomyelitis is the longest PHEIC, and Zika was the first PHEIC for arboviral disease. Even though the public health impact of the event was considered serious and associated with a potential for international spread, several other emerging diseases were not declared as PHEIC. Further, Monkey pox is declared as a PHEIC by WHO on 23 July 2022 due to clear risk of further international spread. Moreover, response measures following a crisis, improving surge capacity and planning for further action to minimise vulnerability can be identified when assessing the health systems’ resilience. The purpose of assessing resilience and its interpretation depends on multiple contextual factors that need to be evaluated for better understanding. The well-assessed areas can be used as a starting point and encourage policymakers to adopt an appropriate strategy in a particular country. Furthermore, policymakers need to regularly review their health systems to assess their resilience. In addition, the application of resilience-enhancing strategies is new. The concept has become relevant and more researched with societal response to health emergencies during the past two decades.

**Justification (rationale)**

Health system resilience is key to coping with catastrophic events, such as the economic crisis and COVID-19 pandemic. However, there is confusion about the meaning of resilience, strengthening it and assessing it. Furthermore, health system resilience research has reached a crucial point; health system interventions have only partly been followed by empirical research and concrete applications. Therefore, the application of resilience-enhancing strategies with existing frameworks needs to be assessed to identify the management gaps and give valuable recommendations from the lessons learnt from the global pandemic. Importantly, improving resilience could help the health system respond to a pandemic like COVID-19. However, most of the research has so far remained primarily theoretical. Therefore, applied research towards a cohesive set of goals needs to be identified and promoted to develop and implement strategies to strengthen systems. Furthermore, strengthening health system resilience will be addressed during the pandemic and future disasters if the issues are correctly addressed during research and interpretation of findings. Therefore, there is a need to analyse the implementation of resilience-enhancing strategies to draw lessons from health systems that have proved more successful at dealing with the past crisis and offer evidence on best practices for health systems under strain. Moreover, it will invariably help improve the level of preparedness and response to similar public health emergencies in the future.

**Objectives**

The objectives of this systematic review are:

1. To identify and describe the implemented health system resilience-enhancing strategies for managing PHEIC globally (including national, regional and global levels).
2. To identify success, and challenges, and provide recommendations towards successful management of PHEIC in future pandemics.

**Review question**

What are the success strategies, and challenges toward health system resilience for managing PHEIC globally?

**METHODS AND ANALYSIS**

**Type and method of review and reporting**

Health systems resilience: A systematic review

The systematic review will be reported using the Preferred Reporting Items for Systematic review and Meta-analysis Protocols guideline (PRISMA-P) (refer online supplemental file 1).

**Study period**

30 March 2022 to 30 November 2022.
Anticipated or actual start date for the review
15 July 2022.

Anticipated or completion date
30 November 2022.

Eligibility criteria
Inclusion criteria
We intend to include all studies in English with qualitative design that can be included under one or more six building blocks of health systems that adhered to resilience-enhancing strategies for the management of PHEIC after the establishment of IHR in 2007. All qualitative studies in peer-review journals will be included. Also, reference checking of detected peer-review studies and hand searching of related journals will be conducted and relevant studies will be included after assessing quality.

Exclusion criteria
Empirical studies that did not mention health system resilience strategies for pandemic/epidemic management, editorials, letter to editor, and conference proceedings will be excluded.

Source of information and search strategies
WHO’s six building blocks of health systems were included as the keywords. Boolean operators (‘AND’ or “OR”) and asterisk search operators will be applied. The complete search strategies for all databases are presented in a table. To avoid duplication and for citation purposes, references will be collected from each database and stored in EndNote desktop V.20. The search will be restricted to the peer-reviewed literature related to the management of declared PHEIC after 2007 according to the IHR for global health security. Screening, reference checking of detected studies and hand searching of related journals were conducted from 30 May to 15 July 2022. Electronic databases (PUBMED, EMBASE, SCOPUS, Web of Science) and Google scholar search engine, which were published in peer-reviewed journals after declaration of PHEIC will be used to describe the related management strategies and lesson learnt. The relevant keywords under the main three themes listed in Table 1 will be used to create a comprehensive search strategy. The search terms will be filtered by a combination of different keywords, Medical Subject Headings (MeSH), Emtree terms, SCOPUS and WOS search strategies as in the online supplemental file 2.

Condition and domain being studies
Global implementation of health system resilience strategic analysis combined with PHEIC management will be studied to provide recommendation for future pandemic preparedness.

Population
Global studies managing PHEIC which describe health system resilience strategies will be taken as the study population.

Intervention(s)/exposure(s)
Global health system resilience-enhancing strategies for the management of pandemics that were declared as PHEIC will be included to identify success and challenges and provide recommendations towards successful management of public health emergencies.

Context
National, regional and global health system resilience-enhancing strategies for the management of PHEIC and implementation will be assessed.

Main outcome(s)
Application of resilience-enhancing strategies for the improvement of managing PHEIC in all six areas of the health system, (including governance/leadership, healthcare financing, healthcare service delivery, health workforce, health information system and access to medicine/vaccine) towards better management of pandemic.

Additional outcome(s)
Success and challenges towards the management of PHEIC will be identified in view of constructing recommendations for the management of future pandemic situations. The impact of strong health system resilience-enhancing strategies on reducing morbidity and mortality due to proper management of pandemic will be described.

Data management
Data extraction
The initial search was performed by reviewers using predetermined search terms and strategies from chosen

Table 1  The applicable keywords and/or phrases under the main three themes

<table>
<thead>
<tr>
<th>Theme 1</th>
<th>Theme 2</th>
<th>Theme 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health system building blocks,^3</td>
<td>Resilience,^1 2</td>
<td>Pandemic/PHEIC,^6</td>
</tr>
<tr>
<td>“Service delivery” OR “Health Resource” OR “Health workforce” OR “Health information system” OR “Health Product” OR “Vaccine” OR “Medicine” OR “Diagnostic” OR “Health Financing” OR “Health Leadership” OR “Health Governance”</td>
<td>AND Resilien* OR Robust OR Anti-fragil* AND OR Adaptab* OR Transformat* OR Preserv*</td>
<td>“Public Health Emergencies of International Concerns” OR “PHEIC” OR Pandemic OR Outbreak OR Epidemic OR COVID-19 OR Ebola OR H1N1 OR “Influenza Pandemic” OR Zika OR Poliomyelitis OR “Monkey pox”</td>
</tr>
</tbody>
</table>
Risk of bias (quality) assessment
All retrieved studies were initially imported into the Rayyan software to assist in removing duplicates. After removing the duplicates, it was shared among collaborators for independent screening of articles by title and abstract based on eligibility criteria. A three-stage screening process will be used to eliminate non-relevant articles at the stage of title, abstract and full-text screening. The studies that would have the two or more reviewers agreed on will be subjected to a full-text review. The two reviewers will independently review the full text of all eligible studies that meet the inclusion criteria and will be retained for the final synthesis (RMNUR and NP). All eligible retrieved articles will undergo a quality assessment process during the synthesis of results and will be done by four independent reviewers (YA, RMNUR, RBK, AE). The two independent reviewers (RMNUR and NP) will use the Joanna Briggs Institute’s critical appraisal checklist for the qualitative research assessment. When there will be a disagreement between the two reviewers, the senior team member (YA) and senior collaborators (CA, MSDW, TKT) will be engaged and a discussion along with the two reviewers will be made to resolve the differences.

Strategies for data synthesis
Double check-up and verification of the extracted information will be done by the senior reviewers (YA, CA, MSDW, TKT). Two team members (RMNUR and NP/GS) will be independently coded and tabulated the findings on the thematic areas (six core areas of the WHO health system) of the review and will map out common codes, concepts and categories. Adapting from the WHO framework, we use the six core areas of the health system, as a guiding theme for the reporting of findings.
ETHICS AND DISSEMINATION
Ethics approval and consent to participate: Not applicable.

Databases that require an institutional license will be accessed through the library at Postgraduate Institute of Medicine (PGIM), University of Colombo Sri Lanka and The University of Queensland Australia.

DISSEMINATION
Pre-print of the protocol is available on https://www.medrxiv.org/content/10.1101/2022.06.14.22276386v4

The screening of the articles was done using Rayyan software in a transparent manner. All included and excluded articles are on the system with reasons.

The findings will be presented at conferences at The University of Queensland in Australia, PGIM, University of Colombo Sri Lanka and other locations around the world.

Finally, the review’s findings will be published in a peer-reviewed international journal and will be disseminated to global communities for the application of successful management strategies for the management of future pandemics.

Author affiliations
1Ministry of Health, Colombo, Western Province, Sri Lanka
2School of Public Health, The University of Queensland, Brisbane, Queensland, Australia
3Department of Community Medicine, University of Kelaniya, Ragama, Western Province, Sri Lanka
4Health Promotion Bureau, Ministry of Health, Colombo, Western Province, Sri Lanka
5Department of Pediatrics and Child Health Nursing, Bahir Dar University, Ethiopia
6Department of Public Health, SRM University Sikkim, Sikkim, India
7Community Medicine, Postgraduate Institute of Medicine University of Colombo, Colombo, Western Province, Sri Lanka

Twitter R M Nayan Uma Nehalaksana http://orcid.org/0000-0001-5456-8281

Acknowledgements
PGIM, University of Colombo, Sri Lanka, Ministry of Health, the Government of Sri Lanka, School of Public health, Faculty of Medicine, The University of Queensland, Australia.

Contributors
Conceptualisation: NUR, YA, CA, MSDW, RBK; draft the protocol: NUR; review the protocol and feedback: YA, CA, MSDW, RBK, TKT, AE, RR, GDS, NP, MF; editing and preparation of the final protocol: NUR.

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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.

Provenance and peer review
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Supplemental material
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ORCID iDs
R M Nayani Umesh Rajapaksha http://orcid.org/0000-0002-4641-903X
Resham B Khatri http://orcid.org/0000-0001-5216-606X

Chrisrnantha Abeysena http://orcid.org/0000-0001-5456-8281

Aklilu Endalamaw http://orcid.org/0000-0002-9121-6549

REFERENCES
**PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol**

<table>
<thead>
<tr>
<th>Section and topic</th>
<th>Item No</th>
<th>Checklist item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADMINISTRATIVE INFORMATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title:</td>
<td>1a</td>
<td>Identify the report as a protocol of a systematic review</td>
</tr>
<tr>
<td></td>
<td>1b</td>
<td>If the protocol is for an update of a previous systematic review, identify as such</td>
</tr>
<tr>
<td>Registration</td>
<td>2</td>
<td>If registered, provide the name of the registry (such as PROSPERO) and registration number</td>
</tr>
<tr>
<td>Authors:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact</td>
<td>3a</td>
<td>Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author</td>
</tr>
<tr>
<td>Contributions</td>
<td>3b</td>
<td>Describe contributions of protocol authors and identify the guarantor of the review</td>
</tr>
<tr>
<td>Amendments</td>
<td>4</td>
<td>If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments</td>
</tr>
<tr>
<td>Support:</td>
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<tr>
<td>Sources</td>
<td>5a</td>
<td>Indicate sources of financial or other support for the review</td>
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<tr>
<td>Sponsor</td>
<td>5b</td>
<td>Provide name for the review funder and/or sponsor</td>
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<tr>
<td>Role of sponsor or funder</td>
<td>5c</td>
<td>Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol</td>
</tr>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td></td>
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</tr>
<tr>
<td>Rationale</td>
<td>6</td>
<td>Describe the rationale for the review in the context of what is already known</td>
</tr>
<tr>
<td>Objectives</td>
<td>7</td>
<td>Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)</td>
</tr>
<tr>
<td><strong>METHODS</strong></td>
<td></td>
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<tr>
<td>Eligibility criteria</td>
<td>8</td>
<td>Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review</td>
</tr>
<tr>
<td>Information sources</td>
<td>9</td>
<td>Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage</td>
</tr>
<tr>
<td>Search strategy</td>
<td>10</td>
<td>Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated</td>
</tr>
<tr>
<td>Study records:</td>
<td></td>
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<tr>
<td>Data management</td>
<td>11a</td>
<td>Describe the mechanism(s) that will be used to manage records and data throughout the review</td>
</tr>
<tr>
<td>Selection process</td>
<td>11b</td>
<td>State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)</td>
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<tr>
<td>Data collection process</td>
<td>11c</td>
<td>Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators</td>
</tr>
<tr>
<td>Data items</td>
<td>12</td>
<td>List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications</td>
</tr>
<tr>
<td>Outcomes and prioritization</td>
<td>13</td>
<td>List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale</td>
</tr>
<tr>
<td>Risk of bias in individual studies</td>
<td>14</td>
<td>Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis</td>
</tr>
<tr>
<td>Data synthesis</td>
<td>15a</td>
<td>Describe criteria under which study data will be quantitatively synthesised</td>
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<tr>
<td></td>
<td>15b</td>
<td>If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall’s τ)</td>
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<td></td>
<td>15c</td>
<td>Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)</td>
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<td></td>
<td>15d</td>
<td>If quantitative synthesis is not appropriate, describe the type of summary planned</td>
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<tr>
<td>Meta-bias(es)</td>
<td>16</td>
<td>Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)</td>
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<tr>
<td>Confidence in cumulative evidence</td>
<td>17</td>
<td>Describe how the strength of the body of evidence will be assessed (such as GRADE)</td>
</tr>
</tbody>
</table>

* It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.


<table>
<thead>
<tr>
<th>Database</th>
<th>Search Strategy</th>
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<tbody>
<tr>
<td>Embase</td>
<td>(resilient:ti OR resilience:ti) AND (framework:ab,ti OR model:ab,ti OR program:ab,ti OR indicator:ab,ti OR index:ab,ti) AND (system:ab,ti OR organization:ab,ti OR organizational:ab,ti OR theory:ab,ti OR strategies:ab,ti)</td>
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<td>Scopus</td>
<td>(resilience OR resilient) AND (system OR model OR framework OR theory OR organiz* OR organis* OR concept OR program OR indicator) AND (“health system” OR “health sector”)</td>
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<tr>
<td>WOS</td>
<td>(Resilience OR resilient) AND (System OR model OR framework OR theory OR organiz* OR organis* OR concept OR Strategies) AND (Epidemic OR “Epidemic” OR “health system” OR “health sector”)</td>
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</table>
**Supplementary file 3: Data extraction form for the systematic review**

<table>
<thead>
<tr>
<th>Title</th>
<th>Author /Year</th>
<th>Study question/ Objectives</th>
<th>Study area (Period)</th>
<th>Study design/type of study</th>
<th>Measurement/ Analytical approach</th>
<th>Source of data</th>
<th>Main results including strategic areas (Six building blocks)</th>
<th>Success/challenges/weaknesses, opportunities/Limitations</th>
<th>Comment</th>
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