Monitoring and evaluation practices and operational research during public health emergencies in southeast Asia region (2012–2022) – a systematic review

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Summary

This systematic review aimed to explore the monitoring and evaluation (M&E) and operational research (OR) practices during public health emergencies (PHE) in the southeast Asian region (SEAR) over the last decade. We searched electronic databases and grey literature sources for studies published between 2012 and 2022. The studies written in English were included, and a narrative synthesis was undertaken. A total of 29 studies were included in this review. Among these 25 studies documented M&E and four studies documented OR practices. The majority of the studies were from India and Bangladesh, with no evidence found from Sri Lanka, Bhutan, Myanmar, and Timor-Leste. M&E of surveillance programs were identified among which PHE due to COVID-19 was most prevalent. M&E was conducted in response to COVID-19, cholera, Nipah, Ebola, *Candida auris*, and hepatitis A. OR practice was minimal and reported from India and Indonesia. India conducted OR on COVID-19 and malaria, whereas Indonesia focused on COVID-19 and influenza. While most SEAR countries have mechanisms for conducting M&E, there is a noticeable limitation in OR practices. There is a compelling need to develop a standard framework for M&E. Additionally, enhancing private sector engagement is crucial for strengthening preparedness against PHE. Furthermore, there is a necessity to increase awareness about the importance of conducting M&E and OR during PHE.

Keywords: Monitoring & evaluation; Operational research; Public health emergency; Systematic review; Southeast Asia

Background

Around 600 million people live in southeast Asia, where numerous factors promote the emergence of infectious diseases.[1] Emerging infections with pandemic potential are anticipated to spread more rapidly than in previous times in southeast Asian region (SEAR).[1] Numerous diversities in biological, geographical, and socio-economical characteristics contributed to this region as a hotspot for emerging infectious diseases.[2] SEAR is portrayed as the hub for zoonotic and vector-borne diseases that originated elsewhere for population growth, mobility, urbanisation, agriculture and livestock, deforestation, and climate change.[3–5] Among annual global deaths, 40% or 14 million are caused by infectious diseases.[6] SEAR's inhabitants are particularly susceptible to neglected tropical diseases (NTDs), including dengue, chikungunya, Japanese encephalitis, influenza, and COVID-19.[7]

Large-scale outbreaks of diseases such as SARS (2003), H1N1 (2009), Ebola (2014), Zika (2016), and more recently, COVID-19 have demonstrated how PHE influenced negative socio-economic effects in addition to significant morbidity and mortality.[8] Emerging infectious diseases have the potential for public health emergencies (PHE) leading to significant influence on community health and well-being, healthcare systems, national economies' stability, and sustainable development goals.[3–5]

WHO has created a framework that identifies five essential elements that must be present to build a successful public health response during any kind of PHE: monitoring, healthcare response, public health intervention, communication, and command.[9] Monitoring and evaluation (M&E) aim to assess the performance and record the rack of previous results to support the analysis of the progress of different epidemiological measure

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PHE by different approaches of rapid response and preparedness framework.[10] Eventually, M&E establishes and enhances the improvement of future strategic planning.[11,12] Evaluation reports are designed to point out the advantages and disadvantages of a specific solution to learn new lessons crucial for updating policy.[10–12] Operational research (OR) is becoming increasingly important in national and international public health treatments and programs as it aims to direct program execution for the greatest outcomes continuously.[13,14] In this regard, documentation of M&E and OR can provide lessons from previous mistakes or success that is helpful in future planning for data collection and analysis. Documentation of successful M&E and OR practices can be helpful to replicate the same practice in countries and situations with similar settings during future PHE. Though, the government of the countries where an emergency arises or the international body like WHO has to take drastic and rapid action to overcome the situation. Therefore, there might not have enough time to conduct M&E or OR, due to a lack of time and technical resources.

In this review, we focus on documentation practices of M&E and OR during outbreaks in SEAR countries. We highlight issues of utmost importance, briefly discuss case examples that illustrate some of these issues, and offer suggestions on how to enhance the management of emerging infectious diseases.

Methods

This systematic review followed the methodology of Cochrane systematic reviews[15] and PRISMA guidelines.[16,17] This systematic review is registered in PROSPERO and the registration number is CRD 42022354118.

This review included studies that met the inclusion criteria (see Search strategy and selection criteria panel at the end). Studies were excluded based on exclusion criteria and we followed the prioritisation and sequential exclusion methods while reporting the reasons for exclusion.[18] Studies retrieved from the initial search were exported into the reference management software, EndNote. After removing duplicates, all articles were screened in two phases, and finally, this review included 29 studies for extracting data. Studies were screened by title and abstract using Rayyans QCRI software (online).[19] Four reviewers were involved in the screening process; two from each group independently screened studies by title and abstract and accordingly full text. The lead reviewer resolved any confusion or disagreement regarding inclusion between the reviewers.

Two review authors independently extracted data using a data extraction form that included the following criteria: author, publication year, publication type (e.g. original research), study design, country, intervention, details about interventions, the disease that causes the pandemic, duration of the pandemic, the focus of M&E, mechanism of M&E, M&E findings, the focus of OR, findings of OR, etc. At the commencement of data extraction, pilot data extraction was done with an eligible study to check the suitability of the data extraction tool. At this stage, every reviewer had extracted data from the same study to check the consistency and a similar understanding of data extraction. Any disagreement between the reviewers was resolved through discussion with the lead reviewer and an opinion was taken from the review team if necessary.

We assessed the risk of bias of the included peer-reviewed articles using the ROBANS (tool for risk of bias assessment for non-randomised studies) tool[20] based on the domains of the tool, such as selection of participants, confounding variables, measurement of exposure, blinding of outcome assessments, incomplete outcome data, and selective outcome reporting. Studies were ranked as low risk of bias, high risk of bias, and unclear risk of bias depending on the reviewers' judgments.

Data analysis

We conducted a narrative synthesis following the review objective and outcome measures. We have mapped and summarised the available evidence. A narrative synthesis was performed following three steps: (i) logical organisation of the articles by M&E and OR conducted during PHE; (ii) within-study synthesis; (iii) cross-study synthesis. Regarding cross-synthesis, we have described the studies by disease and country. However, meta-analysis was not possible due to the high heterogeneity of the data.

Stakeholder consultation

We organised two stakeholder consultation meetings. The first meeting was to finalise the methods including Population, Content, and Context (PCC) of the review. The second meeting was to validate the results of the review and to get recommendations from the stakeholders.

Results

In total, we identified and screened 22,655 potential studies by conducting a comprehensive search in selected databases. Of those, 150 papers were considered for the full-text evaluation, of which 43 articles were retrieved from agencies and ministries and one from the hand search. In the final stage of selection, 121 studies were excluded according to the selection criteria. Finally, we selected 29 articles for data extraction as they fulfilled the inclusion criteria, among which 27 were peer-reviewed articles, and two were reports. Fig. 1 presents the PRISMA flow diagram of the detailed selection process of the studies.

This review included studies from several SEAR countries except for Sri Lanka, Myanmar, Bhutan, and Timor-Leste. We did not find any single study

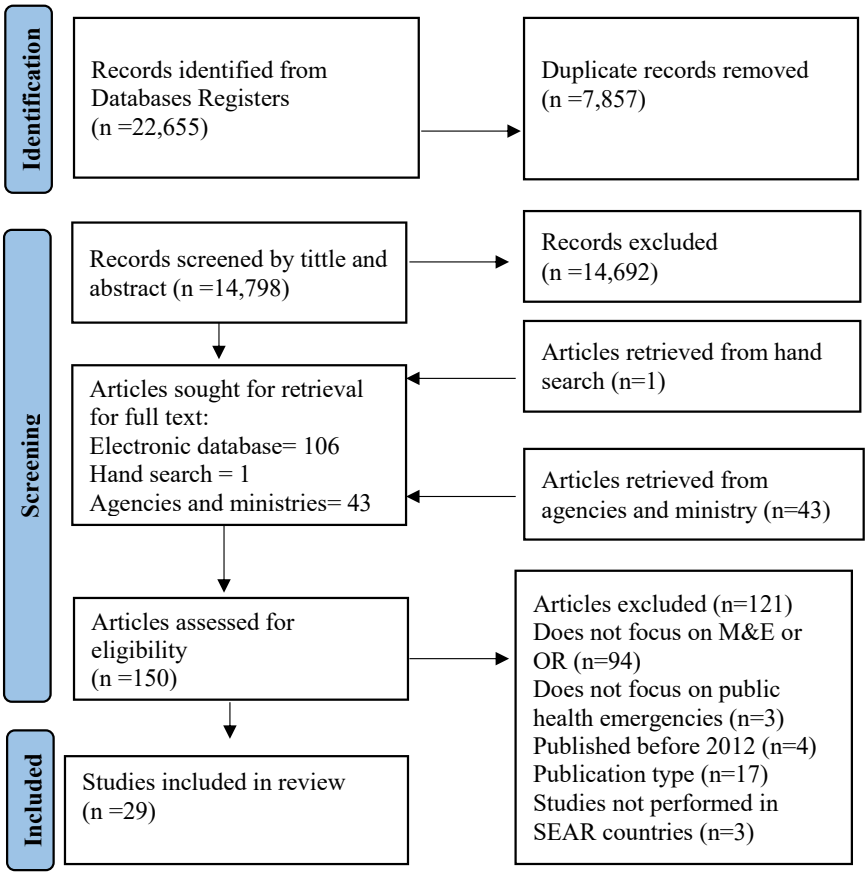

Fig. 1: PRISMA flow diagram. *M&E, Monitoring and evaluation; OR, Operational research; SEAR, southeast Asian region.

conducted in South Korea, but a multi-country study presented findings from South Korea.

Characteristics of the included studies

Among the included studies, 25 studies focused on M&E[21–45] and four studies on OR.[46–49] Most of the included studies followed a cross-sectional design, whereas two were retrospective studies[29,44] and one was a cohort study.[40] Most of the articles were original research published in peer-reviewed journals. Apart from those, one viewpoint,[46] one field action report,[47] one perspective,[30] and one policy analysis[36] were included, of which 20 studies were related to COVID-19.[22–34,36,37,39,40,44,45] Table 1 presents the characteristics of the included studies.

Quality assessment

A risk of bias assessment was done for the 27 peer-reviewed articles. There are six domains in total, among which two domains focus on selection bias (selection of participants and confounding variables) (Fig. 2). The highest number of studies (n = 22) was assessed as a low risk of reporting bias and attrition bias, followed by the selection bias of participants.[37] Most of the studies were found to have unclear risk of bias in terms of blinding of outcome assessment. There is a potential risk of detection bias within the studies as maximum studies (n = 25) were assessed as having unclear risk of bias in the blinding of outcome assessments; one study[22] was evaluated as a high risk of bias, while the other[34] had a low risk of bias. Regarding confounding variables, 14 studies were evaluated as having unclear risk of bias and the remaining studies were considered as low risk of bias.

M&E in response to PHE

Several PHE situations have occurred in SEAR in the last 10 years due to various types of emerging infectious diseases as the review captured (Table 2). This review captured different domains of M&E that were performed in response to the PHE.

In total, 20 studies focused on COVID-19. Among these, the highest number of studies were conducted in India (n = 9)[22,24,25,29,30,32,39,40,45] followed by the number of included studies from Bangladesh (n = 3)[23,29,34] One was a multi-country study from which we included findings

Study details			Disease outbreak	Findings of M&E	Findings of OR
Author, year, country	Study design	Article type			
Ambat et al., 2022[21]; India	Cross-sectional	Original research	Emerging infectious diseases	Gap analysis of preparedness among hospital staffs	N/A
Aroskar et al., 2022[22]; India	Cross-sectional	Original research	COVID-19	M&E of PoE[a] surveillance system	N/A
Biswas et al., 2020[23]; Bangladesh	Cross-sectional	Original research	COVID-19	Analysis of country preparedness	N/A
Choudhury et al., 2022[24]; India	Cross-sectional	Original research	COVID-19	Compared health systems preparedness among different states	N/A
Garg et al., 2020[46]; India	Cross-sectional	Viewpoint	COVID-19	N/A	Introduced disease surveillance app–"Aarogya Setu"
Gopinathan et al., 2021[25]; India	Cross-sectional	Original research	COVID-19	Disaster preparedness and planning strategies among various academic EDs	N/A
Gyanwali et al., 2021[26]; Nepal	Cross-sectional	Original research	COVID -19	Analysis of preparedness & response status among Govt. COVID-19 hospitals and clinics	N/A
Hanafusa et al., 2012[47]; Indonesia	Cross-sectional	Field action report	Human avian influenza	N/A	Establishing short messaging service (SMS) gateway for pandemic reports
Huda et al., 2022[48]; Indonesia	Cross-sectional	Original research	COVID-19	N/A	Multi-sectoral training on contact tracing
Jakariya et al., 2022,[28] Bangladesh	Cross-sectional	Original research	COVID-19	Geo-mapping of SARS-CoV-2 using wastewater samples	N/A
Jiao et al., 2022[29]; India	Retrospective study	Original research	COVID-19	Analysis of effectiveness of containment strategies	N/A
Kirubakaran et al., 2020[30]; India	Cross-sectional	Perspective	COVID-19	Analysis of transmission of infectious disease using a mathematical model	N/A
Kundapur et al., 2022[32]; India	Cross-sectional	Original research	COVID-19	Comparison of bottlenecks in implementing PH initiatives among high and low health index states	N/A
Kurup et al., 2021[33]; India	Cross-sectional	Original article	Emerging infectious diseases	Performance level analysis of health workers	N/A
Manurung et al., 2020[35]; Indonesia	Cross-sectional	Original research	Diarrhoea, malaria, dengue, bloody diarrhoea, influenza and pneumonia	Evaluated usefulness of EWARS[a] in a remote province of Indonesia	N/A
Marome et al., 2021[36]; Thailand	Cross-sectional	Policy analysis	COVID-19	Analysis of community-level PH[a] systems and governmental regulations	N/A
Mukhopadhyay and Patnaik, 2014[49]; India	Cross-sectional	Original research	Malaria	N/A	Evaluated quality and coverage of Indoor Residual Spray (IRS)
Neogi et al., 2020[37]; India	Cross-sectional	Original research	COVID-19	Evaluate the health systems according to WHO[a] building blocks	N/A
Nikolay et al., 2020[38]; India	Cross-sectional	Original research	Nipah	Assessment of changes in transmission of NIV[a] and trend of morbidity/mortality through routine surveillance	N/A
Panda et al., 2022[39]; India	Mixed-method	Original research	COVID-19	Evaluated skill of peripheral HCW using ECHO telemonitoring model	N/A
Salvatore et al., 2020,[40] India	Cohort-study	Original research	COVID-19	Evaluation of national lockdown	N/A
Sathyapalan et al., 2021[41]; India	Cross-sectional	Original research	Candida Auris (C. Auris) infection	Assessment the incidence of C. Auris outbreak & epidemiological characteristics	N/A
Troeger et al., 2014[42]; Bangladesh	Cross-sectional	Original research	Cholera	Analysis of cost-effectiveness of using cholera vaccine	N/A
Vong et al., 2016[43]; SEAR	Cross-sectional	Original research	Ebola	Analysis of health system preparedness in the WHO- SEAR region	N/A
Wang et al., 2022,[44] South-Korea; India	Retrospective study	Original research	COVID-19	Evaluated health systems according to WHO building blocks	N/A
Zachariah et al., 2020[45]; India	Cross-sectional	Original research	COVID-19	Analysis of OR skills of HCW	N/A
Shahrin et al., 2022[34]; Bangladesh	Cross-sectional	Original research	COVID-19	Knowledge of HCWs regarding SARS-CoV-2 infection	N/A
Uematsu et al., 2020[27]; Nepal	Not mentioned	Report	COVID-19	Evaluated the effectiveness of handwashing program	N/A
Kiss et al., 2020[31]; Maldives	Not mentioned	Report	COVID-19	Evaluating the implementation of ESMF in monitoring the emergency response and health systems preparedness	N/A

[a]ESMF: Emergency response of Environmental and Social Management Framework, EWARS: Early warning and response system; PH: Public Health; PoE: point of entry; N/A: not applicable.

Table 1: **Characteristics of included studies.**

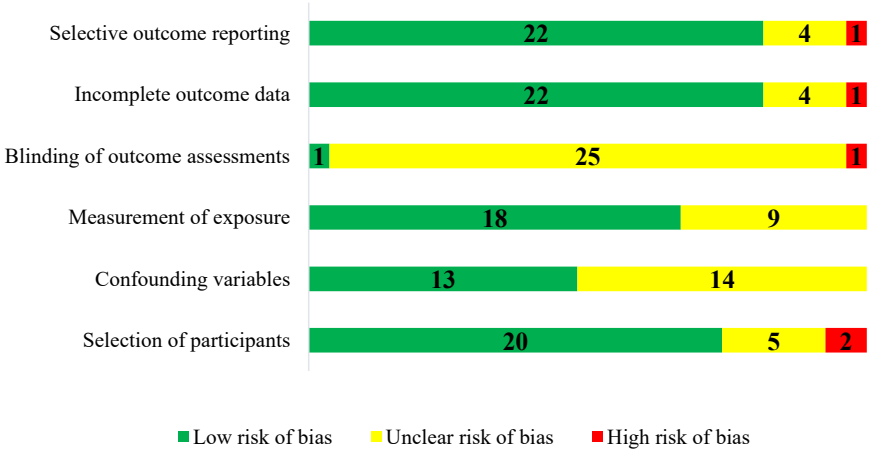

Fig. 2: Risk of bias (ROB) of included studies using ROBANS tool.

of South Korea and India.[34] M&E conducted in Nepal was reported in two studies[26,27]; and one study from each of the countries of Thailand,[36] Indonesia,[35] and Maldives.[31] In India, M&E focused on country-level health systems preparedness, surveillance and rapid response, public health (PH) measures taken for infection prevention and control (IPC measure), the process involved in case management, and availability and performance of the health workforce. On the other hand, in Bangladesh, M&E was done on country-level health systems preparedness, national-level coordination, and planning regarding the process of case management, surveillance through geo-mapping of SARS-CoV-2, capacity development of health workforce and knowledge and awareness development of doctors and nurses. Thailand, Nepal, and Maldives mostly focused on IPC measures through the point of entry (PoE) surveillance system for early detection and screening, implementation of containment strategy, and separate transportation for carrying COVID patients. Nepal, and Maldives have also taken preventive measures like handwashing and emphasized risk communication and community engagement in promoting handwashing. In addition, M&E also considered the role of infrastructure in COVID case management and found out inadequate ventilators, inadequate space for arranging separate treatment care, and a shortage of ambulances hampered the transportation of the COVID patient.

One study reported the regional preparedness of the southeast Asian region (SEAR) during the Ebola pandemic focusing on surveillance, early detection, and safety measures for the health workforce.[46] Three studies discussed preparedness in India and Indonesia to battle PHE due to any emerging infectious diseases where capacity building in early detection was prioritised.[21,33,35]

OR practices in response to PHE

We have a total of four studies that reported OR conducted in two countries. To battle COVID-19, two studies related to OR were carried out but with different focuses, one in Indonesia[48] and another one in India.[46] In India, a disease surveillance mobile application, '*Aarogya Setu*' was introduced to strengthen the existing participatory disease surveillance system[46] whereas, Indonesia emphasised enhancing the capacity of health staff for early warning.[48] In this regard, the training program involved the Ministry of Health, the COVID-19 National Task Force, the Ministry of Education and Culture, universities, and international partners all collaborated to host a series of contact tracing training programs across Indonesia. In addition to primary healthcare providers, community volunteers, young professionals, and college students were trained to enable them in conducting COVID-19 contact tracing and managing data across Indonesia. Two other studies that were conducted in India[49] and Indonesia[47] focused on malaria and human avian influenza respectively. In Indonesia, they focused on the short messaging service (SMS) gateway to handle human avian influenza, while in India they focused on the indoor residual spray (IRS) program to manage malaria.

Discussion

This systematic review has identified and documented M&E practices and OR conducted during several infectious diseases-related PHE that occurred in SEAR in the last ten years. The present systematic review underpins 29 studies (27 peer-reviewed articles and two reports) assessing preparedness, surveillance systems, infection prevention and control, health workforce, health systems, public health measures undertaken, and capacity building towards M&E and OR management in SEAR

Focus of M&E	Findings from M&E
COVID-19: M&E in India	
Health systems preparedness	• Health systems preparedness of different states and union territories and identified states with very good or poor preparedness[24] • National level coordination and planning during management[32] • Guideline of case management[24] • Countries performance of healthcare[25] • Infrastructure and equipment[24] • Governance and socio-economic measure[24,29] • Public-private partnership in the process of COVID-19 management[24,32] • Decision making power to the frontline health workers[32] • Knowledge, perception, and awareness development[34]
Surveillance and rapid response	• PoE surveillance system for early detection of cases[22] • Assessed case fatality and positivity rate[40]
PH measures in infection, prevention, and control	• Containment strategy—implementation of lockdown[29,30,40] • Free screening, contact tracing and treatment[29]
Case management	• Separate triage system[25] • Critical case management[25] • Separate transportation and carrying pathway of COVID-19 patient[25,32] • Distribution of PPE to control the infection among health workers[25]
Health workforce	• Availability of health workforce[25] • Capacity development and performance evaluation of health workforce[25,32]
COVID-19: M&E in Bangladesh	
Coordination, planning and monitoring (country-level)	• Health systems preparedness, national level coordination and planning during management[23]
Surveillance, rapid response and case investigation	• Geo-mapping of SARS-CoV-2 using waste-water surveillance[28]
Health workforce	• Capacity development and performance evaluation[23] • Knowledge, perception, and awareness development among doctors and nurses[34]
COVID-19: M&E in other SEAR countries (Thailand, Nepal, and Maldives)	
Surveillance, rapid response, and case investigation	• PoE surveillance system in Thailand[36] • Surveillance and rapid response in South Korea and India[44]
Infection, prevention, and control (IPC measure)	• Early detection using infrared thermometer[26] • Implementation of containment strategy in Thailand[36] • Handwashing—as preventive measure in Nepal[26,27]
Case management	• Separate transportation for carrying COVID-19 patients in Thailand[36]
Risk communication and community engagement (RCCE)	• Promote handwashing in Nepal[26] • Community engagement and behavior change in Maldives[31]
Infrastructure	• Availability and supply of infrastructure and equipment; e.g. ventilator, PPE [Nepal[26]; Thailand[36]]
Cholera and Nipah outbreak in Bangladesh	
Infection, prevention, and control (IPC measure)	• Vaccination strategy regarding cost-effectiveness and vaccination coverage of cholera vaccine[42]
Vector transmission	• Transmission of emerging pathogen by describing Nipah virus spillover risk, inter-human transmission and morbidity/mortality[38]
Ebola in SEAR countries[43]	
Surveillance	• Indicator and event-based surveillance
Early detection	• Laboratory testing capacity (molecular diagnosis)
Health workforce	• Safety measure for health workforce
Multiple infectious diseases	
Case management	• Critical care[21]
Early detection	• Lab-based screening for early detection[21]
Rapid response laboratory	• Availability of laboratory and its diagnostic capacity[21]
Awareness	• Awareness of lab personnel regarding referral labs inside and outside the district and reporting system[21]
Health workforce	• Surveillance management training[21] • Capacity building on early detection through e-learning portal in Indonesia[35] • Capacity building of peripheral health workers in outbreak detection, investigation[33]

PoE surveillance: point of entry surveillance; PPE: personal protective equipment.

***Table 2*: Disease specific monitoring and evaluation (M&E) practices in southeast Asian region (SEAR) countries.**

countries. Among the 29 studies, 25 studies focused on M&E, and four studies were on OR. The highest number of studies which focused on M&E came from India followed by the number of studies from Bangladesh. During the last 10 years, the most highlighted PHE situation occurred due to COVID-19.

Studies on M&E ensure accountability of programs and interventions, and efficient use of resources as planned.[21,23,24] Different research focused on identifying areas of improvement and proposed course corrections and adaptations to ensure an effective and relevant program.[29,32,33,35] Evidence-based decision-making was targeted by generating data using program scaling-up and testing alternative approaches.[26,35,36,42] Research facilitated learning by identifying valid methods of interventions and clarifying the scope of improvements.[31,39–41] Impact assessment was generated by assessing the impact of programs and interventions on intended outcomes, including changes in behaviour, knowledge, and attitudes.[31,34,44,45]

Despite the heterogeneity of data for countries and diseases, most research focused on the national level of preparedness against infectious disease-related PHE. Different tiers of preparedness were reported by assessing the preparedness of district-level private hospitals,[21] preparedness of academic emergency departments,[25] and preparedness of government-designated COVID-19 hospitals and clinics.[26] Another study documented M&E conducted in SEAR countries focusing on regional preparedness during Ebola.[43] Preparedness in terms of infrastructure (bed capacity, separate space for isolation or quarantine, separate systems for transportation and treatment of infected patients), laboratory facilities for rapid response, facility for critical care and availability of human resources for health were assessed where either adequacy or gaps in preparedness were reported. On the other hand, the major weakness reported through research on preparedness was the lack of adequate infrastructure and technical expertise.[43] During the Ebola Virus Disease (EVD) outbreak in 2014 in Nigeria, preparedness was explored by identifying gaps and developing relevant protocol.[50]

Risk communication is another critical component for M&E which is necessary for the improvement of communication strategies through the four studies.[23,31,43,44] Strengths and weakness in developing a risk communication strategy and action plan was identified in SEAR countries. In this regard, the media played an important role in promoting preventive measures like handwashing among community people. A simplified government approach was implemented by the risk communication model during COVID-19 in Wuhan province in China.[51] Unfortunately, this review did not find any studies that concentered on risk communication during public health emergencies.

Surveillance is considered an application of M&E by tracking and monitoring disease trends which were elaborated by vector transmission pathways and geo-mapping of pathogens are mentionable.[28,29,38,43,44] A surveillance program was also implemented in an upper-middle-income country during the COVID-19 pandemic to safeguard the health of the health workforce.[52] According to our review, regarding the management of critical care, patients have faced challenges due to the inadequacy of infrastructure (e.g. lack of space, bed capacity, etc.) and availability of skilled human resources.[23,25,36] Similar challenges were also identified in the WHO-Eastern Mediterranean Region.[53] Another review study also reported the role of infrastructure in critical care in the most affected countries due to COVID-19.[54]

This review reported an early warning system through the implementation of SMS to facilitate the early detection of persons potentially exposed to infectious diseases like COVID-19, and Ebola in SEAR countries. The EU has already successfully implemented this approach in Nigeria and Senegal, where Ebola was being monitored for signs and symptoms.[55]

Our study findings were mostly aligned with the M&E indicators identified by the WHO.[10] In addition, this review reported the availability of a health workforce and the need for capacity-building training in India, Bangladesh, Nepal, and Indonesia. The health workforce faced a heavy workload during COVID-19.[23–26,32,33,35,45] Besides, several previous studies reported challenges regarding the number and performance of health staff.[56–59] Several studies have indicated an insufficient supply of personal protective equipment (PPE) and its poor quality triggers the possibility of infection. This review captured no evidence of M&E focusing on essential medical services during the pandemic. The COVID-19 epidemic is posing a tremendous challenge to healthcare systems all around the world. An Ethiopian study reported that during the pandemic, the health care service was dramatically reduced for family planning (98%), emergency surgery (77%), and follow-up of chronic surgical conditions (70%).[60] Another study found in Mexico stated that according to the analysis, Mexico lost an estimated 8.74 million patient visits across nine health services.[61]

Our review has documented several practices of M&E in SEAR countries during PHE in the last ten years. Though the domains of M&E identified in the included studies are aligned with WHO M&E indicators, no unique form of M&E was reported. In response to a similar type of PHE due to a similar disease, different countries and, in some cases, the same country performed M&E with a different focus. Therefore, we need to find out what type of initiative is appropriate to fight different types of diseases. Even a specific combination of actions was not possible to identify. Considering this issue, a standard framework

Search strategy and selection criteria

We developed a comprehensive search strategy following the PCC (Population, Content, Context) and using keywords such as 'SEAR countries', 'Operational research', 'Monitoring and evaluation', 'Assessment', 'Emergency preparedness', 'Emergency response', 'Risk communications', 'Outbreak investigation', 'Outbreak response', 'Risk Management', 'Public health emergency', 'Outbreak', 'Pandemic', 'Endemic' etc. The review has considered both peer-reviewed and grey literature. We have searched the electronic bibliographic databases such as–Medline (through PubMed), the Cochrane Library (Cochrane Central Register of Controlled Trials), Scopus, Web of Science (core collection) and EMBASE; Impact Evaluation Databases, relevant Bilateral Aid Agencies and Health ministries of SEAR countries (see Supplementary File).

Inclusion Criteria

- All types of quantitative, qualitative, and mixed-method studies were considered
- All study designs including randomised controlled trials, non-randomised trials or quasi-experimental studies, cross-sectional studies, comparative cross-sectional studies, and observational studies were considered
- Government reports, policy statements, research reports, opinion papers, editorials, commentary, letters to the editor, etc. were also included
- Any study was included if it focuses on monitoring and evaluating measures taken to address the public health emergency
- If the study focuses on monitoring and evaluation of any kind of trial to address public health emergencies, were considered
- If any study focuses on any operational research conducted during any kind of public health emergencies
- Considering the above criteria, studies published between Jan 1, 2012 and July 30, 2022 in English were included.

Exclusion criteria

- The study focuses on the effectiveness of intervention (e.g. trial to find out the efficacy of a drug, vaccine, etc.) rather than monitoring and evaluation of the process
- The geographical location (countries other than SEAR countries)
- Year of publication before 2012
- Language other than English

of M&E for SEAR countries needs to be developed to conduct M&E during PHE.

Out of 25 studies focusing on M&E practices, 18 studies reported PHE due to COVID-19. Other than COVID-19, the rest of the studies documented M&E practice during cholera, Nipah, Ebola, and *Candida auris* infection, and another study focused on PHE due to multiple infectious diseases. Other than COVID-19, there were several outbreaks in this region several times such as swine flu, influenza, dengue, diarrhoea, and monkeypox.[62–73] Unfortunately, the review was unable to explore the evidence of M&E practice during PHE due to those diseases mentioned despite using a comprehensive search strategy. Similarly, most of the evidence of M&E practice came from India followed by Bangladesh. Moreover, evidence from Bhutan, Sri Lanka, Myanmar, and Timor-Leste was absent. These findings indicate the need for documentation of M&E practice in those countries.

In the SEAR, OR practice during PHE is limited (only four studies). But one review study showed that OR could contribute to healthcare operations by analysing staff scheduling, medicine and vaccine allocation, logistics, and solving decision-making problems.[74] A study conducted in the Eastern Mediterranean Region reported that PHE operation centres (OCs) are a good way to handle situations like this. Many nations have demonstrated success in developing effective response mechanisms for various kinds of hazards.[75] Our review study observed that operational research on disease outbreaks or other PHE could be more robust in SEAR.

This review evidenced OR practices only in India and Indonesia during PHE in the last decade. Here, the reported PHE has occurred in India due to COVID-19 and malaria and in Indonesia due to COVID-19 and influenza. Despite the prevalence of several pandemics or outbreaks across other SEAR countries OR practices were reported as very limited in comparison to the M&E practices. Considering this situation, extensive OR practices could contribute to the government's effort in each country to overcome the PHE situation and help them in developing effective strategies to fight the situation.

The objective of our systematic review was to explore the documentation practice of M&E and OR during PHE within the last decade. We identified studies where evidence regarding M&E practices in India and Bangladesh was prominent. Moreover, the review captured evidence about OR practices from only two countries—India and Indonesia. Other SEAR countries might have practiced several M&E and OR programs that they were unable to document and publish. Therefore, despite using a comprehensive search strategy the review could not identify the unpublished works. During our stakeholder consultation, in response to PHE, we received some suggestions and country-specific guidelines for conducting M&E and OR. In addition to this, they emphasised on to develop specific recommendations or a framework for each country to be implemented during any pandemic or outbreak.

The main strength of this systematic review is its robust methodology. We have developed a comprehensive search strategy and considered both peer-reviewed and grey literature. In addition, we have checked the cross-references of the included studies. However, this study has few limitations. This review considered studies published only in English. Moreover, the search strategy combined with different keywords and a specific time duration limited the search results. In terms of PHE, this review considered only infectious diseases. However, it was difficult to identify any single component to be monitored and evaluated necessary to fight against any disease, as most of the M&E program emphasised multiple domains of action against PHE.

Furthermore, meta-analysis was not performed due to the high heterogeneity.

Contributors

LS and KMSUR had full access to all the data in the study and take responsibility for the integrity of the data and accuracy of the data analysis. LS and KMSUR had contribution of study concept and design. IN, SA, MZR and MAH contributed to the acquisition of data. IN and SA analysed and interpreted the data. IN and SA did the narrative synthesis with guidance from KMSUR. LS, IN, and SA drafted the manuscript with critical revision for important intellectual content from all authors. KMSUR provided critical input on methods, supervised the review process, and revised the manuscript.

Data sharing statement

The data used in this study can be obtained from the corresponding author upon reasonable request.

Editor note

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Declaration of interests

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lansea.2023.100340.

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