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One health adoption within prevention, preparedness and response to health threats: Highlights from a scoping review

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ABSTRACT

Introduction: As the COVID-19 pandemic has demonstrated, the complexity of factors involved in the emergence of health threats requires a holistic One Health (OH) approach to enhance the effectiveness of prevention, preparedness, and response (PPR) strategies. Therefore, we conducted a scoping review to explore how the OH approach has been adopted in the context of PPR strategies to health threats, and the challenges and benefits deriving from its integration.

Methods: We defined the research questions and a strategy to guide the peer-reviewed and grey literature search to identify relevant articles and documents (identification). We assessed them for eligibility according to pre-defined criteria (screening) and finally included the ones that answered the research questions (inclusion). We performed a descriptive and thematic analysis of the results.

Results: A total of 138 records were included in the review (57 from the peer-reviewed literature and 81 from the grey literature). The OH approach was mainly adopted in prevention strategies, particularly within the governance area. Human and animal health were the most integrated disciplines in the OH approach, while environmental and social sciences were the less integrated. The most targeted threats were antimicrobial resistance and zoonoses, with the African region being the most represented. Conducive factors for the adoption of OH PPR strategies were identified in resolutions and guidance emanating from international organisations.

Discussion: The global governance of OH should utilise conducive factors, such as international resolutions and guidance, to enhance the adoption of multisectoral and multi-actor PPR strategies, that focus on national and international priorities and neglected threats, such as environmental hazards and pandemic risk. Integrated frameworks and metrics for the implementation and evaluation of OH PPR strategies need to be consolidated to contribute to the growing body of evidence supporting the adoption of the OH approach.

1. Introduction

The COVID-19 pandemic, according to the World Health Organization's Director-General Tedros Ghebreyesus, served as a humbling lesson that showcased the potential consequences brought about by a novel pathogen [1]. It exposed the extent to which pandemic prevention, preparedness, and response (PPR) did not work in an integrated and coordinated manner to prevent, prepare, and respond to the virus [2]. COVID-19 also made evident how the health of humans, animals, and ecosystems is strictly dependent and subject to the same multifaceted forces. Therefore, the complexity of human, animal, environmental, and socio-economic drivers involved in the emergence of COVID-19 and other health threats originating at the human-animal-environment interface, like zoonoses, vector-borne diseases (VBDs), antimicrobial

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resistance (AMR), environmental hazards and foodborne outbreaks, requires a multisectoral and multi-actor approach like One Health (OH) [3,4]. The recently established One Health High Level Expert Panel (OHHLEP) defined OH as an integrated, unifying approach that aims to achieve optimal and sustainable health outcomes for people, animals, plants, and the environment by mobilising multiple sectors, disciplines, and communities [5].

Given the diversity of the drivers and risk factors involved in the emergence of threats, the syndemic impact they produce, and the multiplicity of sectors, disciplines, and actors involved, the OH approach should be adopted for PPR strategies related to health threats at the human-animal-environment interface, including pandemics [6–11]. Moreover, the synergy between PPR strategies should be strengthened to allow them to mutually reinforce one another [12]. Although the integration of the OH approach in PPR strategies is presently recognised as a priority by the scientific and international community, the operationalisation and implementation of this systemic approach is struggling [13]. To enhance the adoption of the OH approach, it requires increasing our knowledge about how it has been integrated into PPR strategies so far. Therefore, we conducted a scoping review to explore to what extent the OH approach has been adopted in the context of national and international PPR strategies for health threats, including pandemics, and what benefits and challenges this entailed.

2. Methods

2.1. Overview

We conducted a scoping review to scope a body of literature, based on the approach described in previous methodological studies [14–16], and to answer our research questions:

1. To what extent has the OH approach been adopted and in what areas of PPR strategies?
2. What disciplines have been integrated within the OH approach when applied to PPR strategies?
3. What benefits and challenges arise from the adoption of the OH approach within PPR strategies?

For the scope of this review, we defined the OH approach as any organised collaboration between at least two disciplines. PPR strategies were defined as any initiative at the national or international level that was at least operationalised (regulated) to address threats to public health (public health events requiring urgent and coordinated action) [17], and particularly:

✓ Prevention: regulatory and physical measures to ensure that emergencies are prevented, or their effects mitigated [17];
✓ Preparedness: activities that aim at preventing, mitigating, and preparing for emergencies [17];
✓ Response: actions taken in anticipation of, during, and immediately after an emergency to ensure that its effects are minimised [17].

The selection of the information from the source to the final inclusion table proceeded according to three steps: identification of records, screening, and finally inclusion of articles and documents within the review.

2.2. Identification of records

We searched for articles and documents published in English, Italian, and French between January 1st, 2005 and December 31st, 2022. We decided to start the search in 2005 since, in late 2004, the Wildlife Conservation Society hosted a multidisciplinary conference to discuss the spread of infectious diseases among humans, domestic animals, and wildlife. The conference produced the 'Manhattan Principles on One World, – One Health' and the development of the term 'One Health' [18].

The sources of information included both peer-reviewed and grey literature. For the peer-reviewed literature, Medline, Embase, Biosis, Scisearch, and Esbiobase databases were searched in a multifile environment on the STN International Platform, which allows searching multiple databases at the same time with a single query.

We decided to create three different search strings to have separate sets of results. Each string consisted of two axes, one for the OH domain and one for the prevention/preparedness/response domains. The two axes were joined by the boolean operator AND. The preparedness axis also included two related terms, preparation and readiness, to increase recall and, consequently, improve retrieval.

The complete search strings are illustrated below:

- "One Health" AND Prevention
- "One Health" AND Preparedness OR Preparation OR Readiness
- "One Health" AND Response

Duplicate citations were automatically and manually removed, and de-duplicated search results were included in a Microsoft Excel file, including the following information: identification number, database, title, year, document type, language, link to full text, abstract availability, and author(s).

For the grey literature, websites of international organisations involved in the development of documents aimed at supporting the operationalisation and implementation of the OH approach, like the World Health Organization (WHO), the World Organization for Animal Health, (WOAH), the Food and Agriculture Organization (FAO) and its legislative and policy database (FAOLEX), and the World Bank websites were searched. The screening of these institutional websites highlighted the relevance of other institutions, like the European Centre for Disease Control (ECDC), the European Commission (EC), the United Nations Environment Program (UNEP), the U.S. Agency for International Development (USAID), the CDC (Centres for Disease Control and Prevention), and the EFSA (European Food Safety Authority), whose institutional websites were also screened.

2.3. Screening

During the screening phase, two researchers examined the identified records' titles and abstracts and subsequently assessed for eligibility the selected articles' and documents' full-texts according to the aim of the review. When the two researchers had contrasting results, the final decision was entrusted to a third researcher. The main reasons for exclusion were not responding to the research questions or the fact that it was not possible to retrieve the full-text of the article or document.

2.4. Inclusion

The eligible articles and documents were listed in an inclusion table describing the characteristics of the strategies: identification number, source, title, author, language, year, phase of the strategy, threat, area of application of the strategy, geographical area, type of document, and disciplines integrated in the OH approach.

2.5. Data analysis

A thematic inductive approach was utilised to identify emerging themes about the area of application of the strategies, the disciplines integrated in the OH approach, the threats the strategies addressed, and the benefits and/or challenges deriving from the adoption of the strategies.

3. Results

Initially, 2484 records were identified via databases, and 57 articles were finally included in the review. Additionally, 180 documents were identified via the selected websites, and 81 were finally included in the review (Annex 1). The flow of information of the review is reported in Fig. 1.

3.1. Adoption of the OH approach in PPR strategies

The number of articles and documents describing OH PPR strategies generally increased with time, with a peak in 2017 (25%) (Table 1). Of note, no articles or documents relevant for this review were published before 2011. During 2021–2022, the number of records retrieved grew compared to the previous years, with a greater contribution from the peer-reviewed literature.

Regarding the strategy phase, the OH approach was mostly adopted in prevention strategies (76.1%), followed by response (48.6%) and preparedness (44.2%) strategies (Fig. 2). Prevention strategies mainly addressed National Plans for AMR. Synergic actions between strategies were frequent, and prevention and preparedness synergy was the most represented (31.9%), mostly within zoonoses prioritisation exercises.

AMR was the most addressed threat (40.4%) by the OH PPR strategies retrieved with this review, with the majority of the contributions coming from the grey literature (63.3%). On the other hand, zoonoses were the most frequently addressed threats within the peer-reviewed literature (45.6%).

Regarding the geographical area, the African region (WHO region) was the most represented (33.8%), both within the peer-reviewed literature (13.9%) and the grey literature (45.6%), and the focus was mainly on zoonoses prioritisation exercises.

3.2. Disciplines and area of application of the OH PPR strategies

Human health (97%) and animal health (95.7%) were by far the most integrated disciplines in the OH approach of the included strategies. The environmental sciences (58%) were less integrated and mainly within international guidance, national plans, and prioritisation exercises. Other sectors, like the socio-economic sciences (13.8%), were poorly integrated, and mainly within prioritisation exercises and operational frameworks. The combination of two disciplines (human and animal health) was the most frequent (95.7%), followed by the integration of three disciplines (58%) with the addition of the environmental sector (Fig. 3).

Regarding the strategies' area of application, the OH approach was mainly adopted within the governance area (50%), with the majority of the strategies being national plans (Fig. 4). Assessments such as project reports, reviews and evaluations of OH PPR strategies, and the lessons learned were common both at national level (16.7%) and multi-country level (14.5%), and mainly within the African region (WHO region). Prioritisation exercises were also another common area for OH adoption (14.5%). On the other hand, OH integration within capacity building strategies for PPR was poorly targeted and mainly in the African region.

3.3. Benefits and challenges

The thematic analysis of the included records highlighted benefits and challenges deriving from the adoption of the approach within PPR strategies (Table 2).

3.4. Limitations

The main limitations of this scoping review are related to the large number of articles and documents retrieved due to the broad focus of the review, that had to be analysed and synthesised. Also, the evolving terminology related to the OH approach could have led to missing some articles or documents during the search phase.

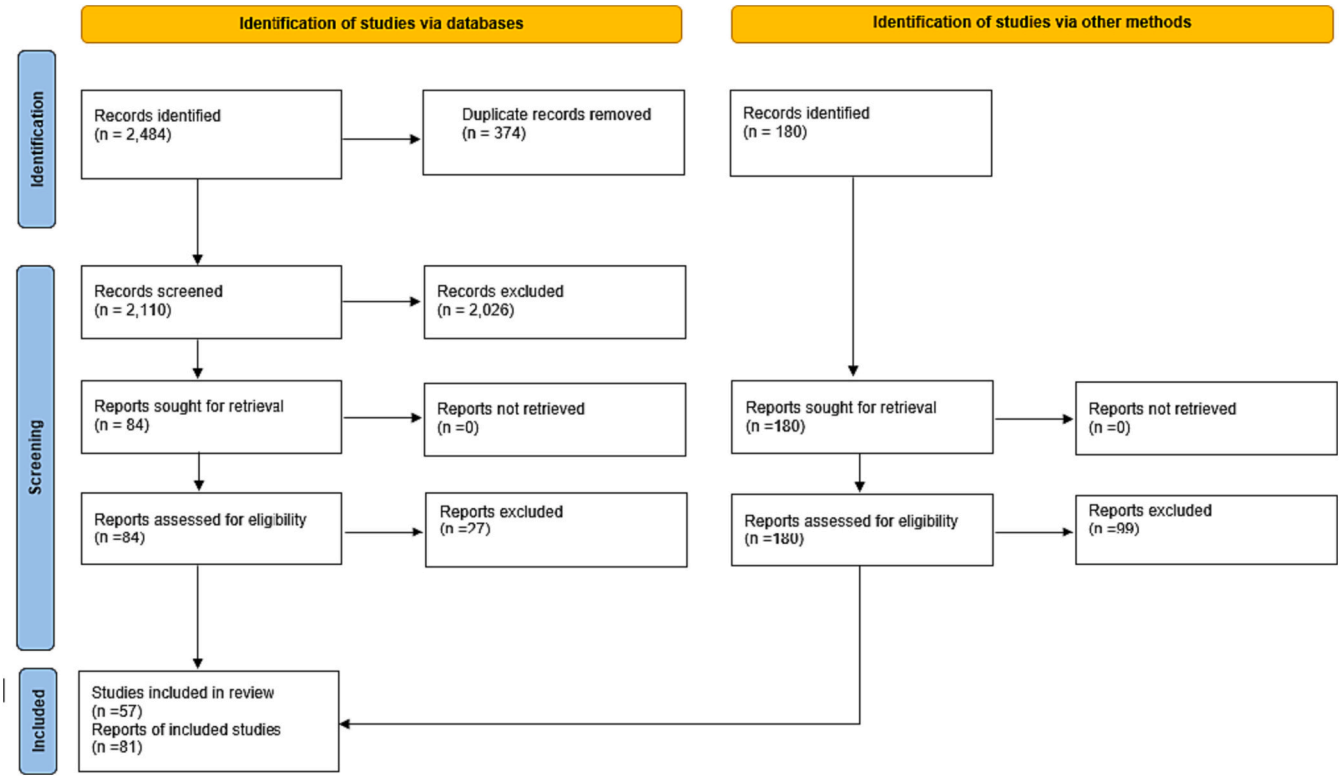

Fig. 1. Flow of information through the different phases of the scoping review.

Table 1
Quantitative description of the OH PPR strategies by year, phase, region and threat targeted.

OH PPR strategies characteristics		Peer-reviewed literature (n = 57)	Grey literature (n = 81)	Total (n = 138)
		N (%)	N (%)	N (%)
Year	2011	2 (3.5%)	1 (1.3%)	3 (2.2%)
	2012	1 (1.8%)	0 (0%)	1 (0.7%)
	2013	0 (0%)	0 (0%)	0 (0%)
	2014	2 (3.5%)	4 (5.1%)	6 (4.4%)
	2015	0 (0%)	4 (5.1%)	4 (2.9%)
	2016	0 (0%)	3 (3.8%)	3 (2.2%)
	2017	3 (5.3%)	31 (39.2%)	34 (25%)
	2018	2 (3.5%)	8 (10.1%)	10 (7.4%)
	2019	10 (17.5%)	4 (5.1%)	14 (10.3%)
	2020	8 (14%)	6 (7.6%)	14 (10.3%)
	2021	12 (21.1%)	10 (12.7%)	22 (16.2%)
	2022	17 (29.8%)	8 (10.1%)	25 (18.4%)
Phase	Prevention	37 (65%)	68 (84%)	105 (76.1%)
	Preparedness	32 (56.1%)	29 (35.8%)	61 (44.2%)
	Response	36 (63.2%)	31 (38.3%)	67 (48.5%)
Geographical area (WHO regions)	Multi-region	7 (12.3%)	13 (16.5%)	20 (14.7%)
	African region	25 (43.9%)	21 (26.6%)	46 (33.8%)
	Eastern Mediterranean Region	5 (88%)	5 (63%)	10 (74%)
	European Region	7 (12.3%)	11 (13.9%)	18 (13.2%)
	Region of the Americas	1 (1.8%)	7 (8.9%)	8 (5.9%)
	South-East Asia region	7 (12.3%)	10 (12.7%)	17 (12.5%)
	Western Pacific region	3 (5.3%)	12 (15.2%)	15 (11%)
Threat	AMR	5 (8.8%)	50 (63.3%)	55 (40.4%)
	Zoonoses	26 (45.6%)	16 (20.3%)	42 (30.9%)
	Infectious diseases	4 (7%)	2 (2.5%)	6 (4.4%)
	VBDs	8 (14%)	2 (2.5%)	10 (7.4%)
	Multi-threats	14 (24.6%)	7 (8.9%)	21 (15.4%)
	Environmental hazards	0 (0%)	16 (20.3%)	16 (11.8%)
	Wildlife encroachment	0 (0%)	1 (1.3%)	1 (0.7%)

4. Discussion

The COVID-19 pandemic highlighted what the international and scientific community has been advocating for in the last few years: the need and urgency to operationalise and implement effective multi-sectoral approaches within PPR strategies to address threats to health [2–4].This scoping review explored to what extent the OH approach has been adopted within these strategies, and the benefits and challenges of its adoption.

The OH approach was mainly integrated in prevention strategies, particularly within the governance area, and specifically in national plans addressing AMR. Human and animal health were the most integrated disciplines in the OH approach, while environmental, socio-economic, and other disciplines were less included. AMR and zoonoses were the most targeted threats, and the African region the most represented.

The main focus of the OH PPR strategies on prevention to health threats is not reflected in the mobilisation of funds, which are usually triggered by response actions [19]. This could be possibly explained by the fact that the main type of prevention strategy retrieved with this review are the development of National Plans and the implementation of prioritisation exercises, which usually do not require a consistent financial investment and were bolstered in the wake of international resolutions and guidance. As a matter of fact, the vast production of AMR National Plans with a OH approach peaked in 2017, after a resolution approved by the World Health Assembly in 2015 [20]. The resolution promoted collaboration across different sectors at the international, national, and regional level and urged member states to develop AMR national action plans with a OH approach. Zoonoses OH prioritisation exercises, the second type of OH strategy included in this review, were increasingly retrieved after 2017, following the publication in 2019 of the WHO-FAO-WOAH “Tripartite Guide to Addressing Zoonotic Diseases”, and before that, the CDC OH zoonoses prioritisation tool in 2014 [7,21], which promoted zoonotic diseases prioritisation at the national level to focus resources and efforts. OH prioritisation exercises were one of the few implemented PPR strategies retrieved with this review, possibly because prioritisation is an initial and cost-effective step to strengthen OH systems and to focus resources to address the identified priorities. These examples show that the global governance of OH, in the form of guidance and directives produced by international organisations can have an impact on the development and operationalisation of OH strategies. On the other hand, we couldn't retrieve the same extensive body of literature about the implementation and evaluation of AMR National Plans and actions following zoonoses prioritisation exercises, or other implemented strategies. The majority of the evaluations of the PPR strategies could be ascribed to project reports and reviews, which were lacking a systematic and agreed-upon method to evaluation, as reported also from a recent scoping review [22]. To strengthen OH PPR strategies implementation and evaluation at national and international level, it would be crucial to review and harmonise available tools and frameworks for implementation and evaluation of OH strategies, considering the importance of socio-economic and environmental factors, to finally develop a formal operational and evaluation framework [23]. International organisations should promote and guide this process, engaging all the relevant sectors and actors, from government to communities. The scarce involvement of some key disciplines, such as the environmental and social sciences, and actors, such as communities, in the OH approach has been reported for many years, despite their important role in supporting OH PPR strategies is well recognised in the literature [24,25].

AMR and zoonoses were by far the most commonly addressed threats by OH PPR strategies included in this review, while other serious threats to health like VBDs, environmental contamination, natural disasters, wildlife exploitation, and climate change, remain poorly targeted, regardless of their burgeoning impact on people, animals and ecosystems. Moreover, pandemic risk was poorly addressed with only two records retrieved, one published before the COVID-19 pandemic and one after it [26,27]. Very poor information was retrieved also about the adoption of OH within surveillance systems, an essential area for PPR to health threats.

Regarding the geographical distribution of the OH strategies, the African region (WHO region) was the most represented, also for what it concerns capacity building activities. This might be explained by multiple factors: the fact that the OH approach has often been adopted for addressing zoonoses, which are a priority threat in Africa, and the influence of dedicated projects supported technically and financially by multiple international partners. The review highlighted only a few multi-country OH strategies (at least two WHO regions were involved),

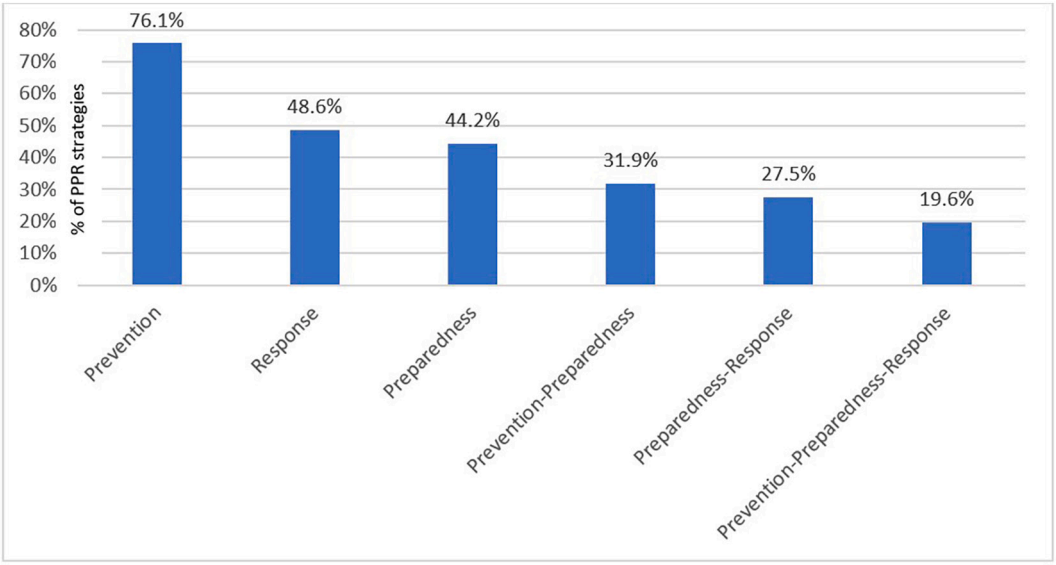

Fig. 2. Phase of application (prevention, preparedness, response) of the OH strategies.

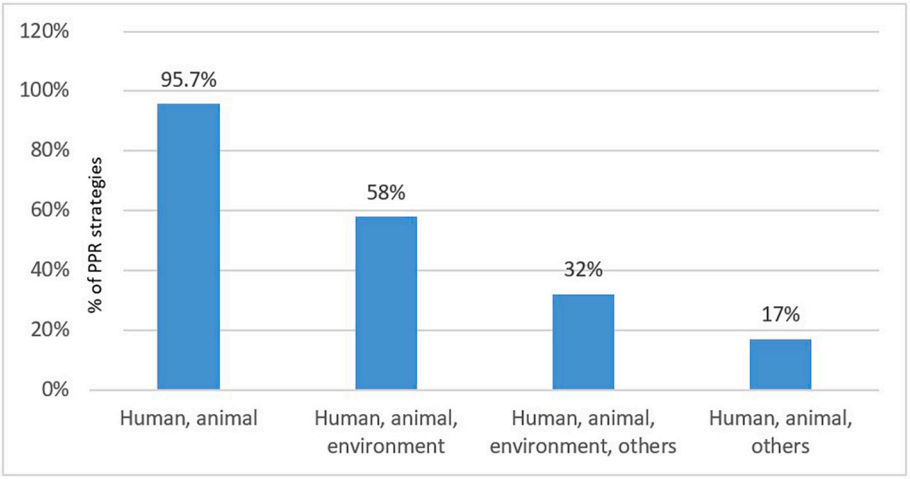

Fig. 3. Disciplines integrated in the OH approach of the PPR strategies (Others: entomology, food sciences, agricultural and plant sciences, socio-economic sciences, biosafety, wildlife sciences).

calling for more efforts in their operationalisation and implementation, given that OH threats generally afflict multiple countries at the same time, as happened during the COVID-19 pandemic.

Several articles and documents included in this review pointed out benefits and challenges in the adoption of OH PPR strategies for health threats. Benefits that emerged from the analysis were related to cost reduction, improvement in the effectiveness of the PPR strategies and the advocacy process. Challenges were mainly attributed to a lack of political will, funds, sustainability planning, weak collaboration and communication within and among disciplines, and scant multidisciplinary capacity building initiatives.

5. Conclusion

This scoping review described to what extent the OH approach has been adopted within PPR strategies to address health threats. The review identified conducive factors for OH adoption in PPR strategies in resolutions and guidance emanating from international organisations. The global governance of OH should leverage on this aspect to enhance PPR strategies focusing on national and multi-country priorities, with a special attention to integrating the environmental and socio-economic sciences and targeting neglected threats, like pandemic risk and environmental hazards. More efforts need to be focused on developing multisectoral surveillance systems and multisectoral capacity building activities, and improved collaboration and communication among all the relevant sectors and stakeholders, including communities. International organisations should promote further research and action to support the implementation and evaluation of PPR strategies by adopting an inclusive and holistic OH approach, to finally produce an accepted evaluation framework and metrics, and add to the growing body of evidence supporting the integration of the OH approach within PPR strategies to address health threats.

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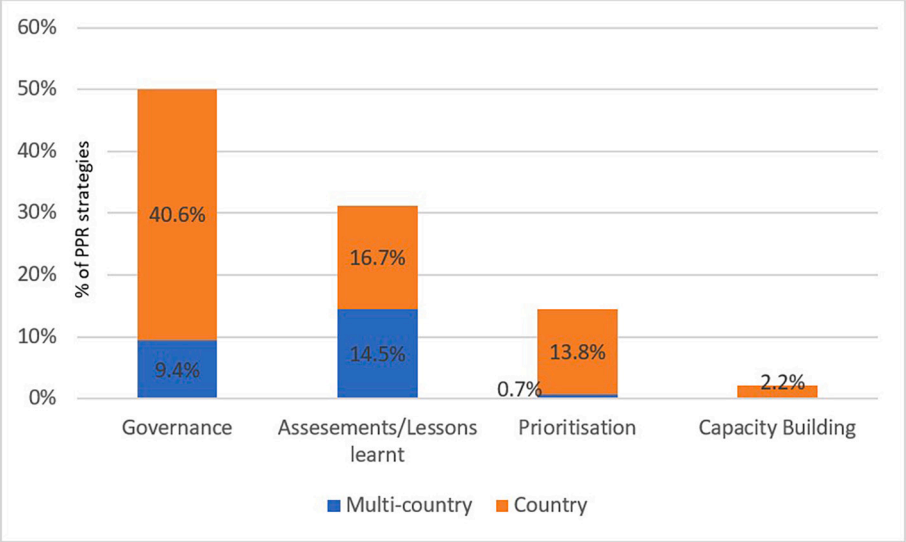

Fig. 4. Area of application of the OH approach within PPR strategies, showing multi-country (blue) and national strategies (orange). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 2
Themes related to benefits and challenges of OH adoption within PPR strategies, that emerged from the analysis of the included studies.

Benefits of OH adoption within PPR strategies	
Costs	✓ Decrease and rationalise the overall costs of the strategies
	✓ Improve sustainability
Effectiveness	✓ More effective policy-making process
	✓ More timely and effective risk assessment, early warning and response
Advocacy	✓ Advocacy for funds, policies and programs is more effective
Challenges to OH adoption within PPR strategies	
Sustainability	✓ High costs at the beginning
	✓ Difficulties for countries to maintain a stable OH framework after the projects/funds end
	✓ Lack of operational plans and guidelines
Political will	✓ Lack of systematised evidence to support the adoption of the OH approach
	✓ Necessity of having a strong political commitment, funds, as well as a careful planning
Collaboration/capacity building	✓ Reluctance in coordination and communication between different sectors and stakeholders
	✓ Insufficient information sharing between actors, including the private sector
	✓ Poor participation of communities and civil society
	✓ Inadequate and insufficient multidisciplinary training and capacity building activities

CRediT authorship contribution statement

Claudia Robbiati: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Alessia Milano:** Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Silvia Declich:** Conceptualization, Methodology, Supervision, Writing – review & editing. **Kevin Di Domenico:** Conceptualization, Methodology, Writing – review & editing. **Laura Mancini:** Conceptualization, Methodology, Writing – review & editing. **Scilla Pizzarelli:** Conceptualization, Methodology, Writing – review & editing. **Franca D'Angelo:** Conceptualization, Methodology, Writing – review & editing. **Flavia Riccardo:** Conceptualization, Methodology, Writing – review & editing. **Gaia Scavia:** Conceptualization, Methodology, Writing – review & editing. **Maria Grazia Dente:** Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors do not have any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.onehlt.2023.100613.

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