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Disaster management in low- and middle-income countries: scoping review of the evidence base

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ABSTRACT

Introduction Globally, there has been an increase in the prevalence and scale of disasters with low- and middle-income countries (LMICs) tending to be more affected. Consequently, disaster risk reduction has been advocated as a global priority. However, the evidence base for disaster management in these settings is unclear.

Methods This study is a scoping review of the evidence base for disaster management in LMIC. Potentially relevant articles between 1990 and 2011 were searched for, assessed for relevance and subsequently categorised using a thematic coding framework based on the US Integrated Emergency Management System model.

Results Out of 1545 articles identified, only 178 were from LMIC settings. Most were of less robust design such as event reports and commentaries, and 66% pertained to natural disasters. There was a paucity of articles on disaster mitigation or recovery, and more were written on disaster response and preparedness issues. Discussion Considerably more articles were published from high-income country settings that may reflect a publication bias. Current grey literature on disaster management tends not to be peer reviewed, is not well organised and not easy to access. The paucity of peer-reviewed publications compromises evidence review initiatives that seek to provide an evidence-base for disaster management in LMIC. As such, there is an urgent need for greater research and publication of findings on disaster management issues from these settings.

INTRODUCTION

An estimated 384 natural disasters occur each year worldwide. In 2011 alone, around 245 million people were affected, 30 773 died and the economic costs of these natural disasters totalled in excess of US\$366 billion.¹ Current trends suggest that the frequency and impact of disasters is increasing, in part driven by global demographic trends toward greater urbanisation and industrialisation.² In addition, persisting socioeconomic inequalities and poverty undermine community resilience, and it is recognised that vulnerability is a greater determinant of disaster risk than the actual hazards themselves.^{3 4}

Disaster planning covers a spectrum of activities from business continuity management and emergency planning, training and preparedness, as well as the planned response to, and recovery from, disasters.⁵ Due to the multi-modal nature of disasters, a multi-sectoral approach that includes health is often required. While not all disasters can be avoided, their worst effects can be mitigated and minimised through adequate disaster planning and preparedness.² Indeed, the cost of disaster response far exceeds the cost of preparing for them. The need for a more proactive approach to planning and preparing for disasters has been highlighted as a global priority as articulated in the United Nations International Strategy for Disaster Reduction and the 'Hyogo Framework for Action' 2005–2015.^{6 7}

While considerable emphasis has been placed on better planning for disasters, the evidence base for this is questionable particularly within the health sector.⁸ We have previously reported that the evidence base for health sector emergency planning in high-income countries (HICs), such as the UK, is patchy, not robust and inconsistent.^{8 9} Furthermore, others report a mismatch between disaster plans and what actually happens during disasters, observing that the use of the evidence base in disaster planning in healthcare is not always apparent.^{10 11} Similarly, the state of the evidence base for low- and middle-income country (LMIC) settings is not known, and it is unclear if findings for HIC settings are generalisable to other settings. We therefore sought to scope the existing evidence base for emergency planning in health for LMIC settings with a particular focus on studying how it differs from HIC settings.

Key messages

What is already known on this subject

Previous scoping studies for health sector emergency planning have identified a limited evidence base in high-income countries; and even less is known about low and middle income (LMIC) settings.

What this study adds

We found a paucity of LMIC-based research with emphasis on disaster response and emergency preparedness and little attention to mitigation or recovery. A robust academic evidence base is needed to assist health sector disaster practitioners, managers and policymakers working in these settings.

METHODS

This study consisted of a scoping review of the published academic literature focused on emergency planning in the health sector. A scoping review typically has two distinct, and yet related features.¹² First, the aim is to achieve a representative, but not necessarily comprehensive, sample of the distribution of an evidence base across a predefined topic area. Second, the aim is to characterise the quality of the evidence base in terms of types of study and the specific questions or subtopics addressed by identified studies.

The development of the literature search strategy involved a priori compilation by the research team of themes and topics considered relevant to the field. These themes and topics formed the basis of the search term headings. Pilot searching in the subarea of business continuity was carried out initially to ascertain the effectiveness of search terms in identifying relevant articles. A final search strategy was then developed to retrieve evidence relevant to the full scope of the review, subdivided into Business continuity, Hazard analysis, Capability assessment and maintenance, Recovery, Communications/informatics and Organisational behaviour/Human Resources.

This final search aimed to identify cross-sectional 'slices' through the evidence, but was designed to retrieve items where the prevention, control and mitigation of disasters (ie, emergency planning) was a major focus of a study, producing a higher yield of relevant papers and therefore more time effective to review. We searched the electronic databases Embase, MEDLINE, MEDLINE in Process and PsycINFO via Ovid SP, Biosis and Science Citation Index via Web of Science, CINAHL via EBSCO, the Cochrane Library via Wiley and Clinicaltrials.gov. An exemplar strategy is given, based on Ovid MEDLINE; search concepts were subsequently translated in the search vocabulary of the other relevant databases (box 1). We did not limit to 'human' as we wished to identify literature on biosecurity and zoonoses that might be relevant. All databases were searched for the time period 1990–2011. In the case of non-health specific databases (eg, Science Citation Index), we decided not to limit searches to terms indicating the health sector. This decision was made in recognition of the limitations of indexing and abstracting and that emergency planning is a multi-sectoral activity. Instead, single sector non-health items were excluded at the title and abstract sift stage. The references identified were

then downloaded into a Reference Manager database, de-duplicated and imported into a Microsoft Excel spreadsheet for coding.

Retrieved titles and abstracts were assessed for relevance and coded by a team of two mixed pairs each including a topic expert and an information specialist. In order to minimise inter-observer variability in the coding process, regular cross-checks were carried out within the coding team to clarify any points of contention or ambiguity. Concordance between coding team members was also confirmed by initial double assessment of a subset of 225 articles by each topic expert-information specialist pair. The two pairs of reviewers achieved κ values of 0.578 and 0.740.

Each title or abstract was reviewed and deemed to be relevant (subject matter relevant to health sector emergency planning and/ or management), equivocal (subject matter suggestive of relevance to health sector emergency planning and/or management), not relevant or containing inadequate information for coding. Publications were then coded on a Microsoft Excel spreadsheet using aggregative synthesis based on predetermined categories drawn primarily from the Integrated Emergency Management System (IEMS) model. These techniques have previously been shown to be appropriate for exploring qualitative data where the concepts are secure, predefined and not contested.¹³¹⁴

The thematic coding framework used to categorise the published literature was devised based on the IEMS model as developed by the US Federal Emergency Management Agency (figure 1). The IEMS model describes eight broad categories corresponding to different phases of the emergency management cycle: mitigation, hazard analysis, capability assessment, capability maintenance, development plans, emergency planning, response and recovery.¹⁵ This model is widely known and used within the emergency planning community in HIC, and covers the range of issues in the field using mutually exclusive concepts. In addition, we identified three other thematic categories of relevance: informatics and intelligence, communications and the mass media, and a 'catch-all' category for other organisational issues that either transcend several different phases of the emergency management cycle or are a separate entity in their own right (eg, gender issues, role of the military and human rights aspects). The categorisation of country setting for the literature by income-levels was based on the World Bank country classification of analytical income categories.¹⁶

We anticipated that publications relating to disasters and emergencies would not be reliably classified from a bibliographic point of view, given the lack of an internationally agreed taxonomy. This heterogeneity makes it challenging to identify relevant articles from diverse database thesauri, such as MeSH headings. It is therefore neither feasible, nor indeed possible, to guarantee that all relevant articles are identified. To compensate for this, the search strategy optimised sensitivity and used broad headings, as noted above.

Also of note, the phases of the emergency management cycle are not as distinct as the IEMS model may imply. For example, there is frequently a blurring between emergency response and recovery activities. The delineation of articles by phase therefore artificially demarcates what is essentially a continuum of interwoven activities running through the entire emergency

management cycle. The categorisation by phase as used in this scoping study was however necessary in order to facilitate some measure of analysis of the articles identified.

FINDINGS

Country of origin of articles

Our initial search identified 2652 articles of which 1545 were assessed to be either relevant or equivocal on further review. There was more than a fivefold difference in the number of publications pertaining to disaster management in HIC (984) compared with LMIC settings (178) (figure 2). This equated to nearly two-thirds of articles relating to HIC settings, of which 69% pertain to the USA alone. In all, 5% of articles covered multiple settings, that is, both HIC and LMIC, and for a further 20% of articles the setting was unspecified.

Type of report

For both LMIC and HIC settings, we found a preponderance of less robust publications in the form of event reports and commentaries, and observational studies (table 1). However, in marked contrast to HIC publications, there were virtually no professional education type articles, and very few literature or systematic reviews for LMIC settings. There were proportionately more event reports from LMIC settings (44.9%) than HIC (28.3%).

Type of disaster

Two-thirds of articles (65.7%) from LMIC settings pertained to natural disasters which was proportionately higher than for HIC (20.7%) (table 1). This probably reflects the frequency of, and increased vulnerability to, natural disasters in these settings. In contrast, there were considerably more articles published on chemical, biological, radiological and nuclear incidents in HIC (10.0%) than LMIC (2.2%). This may be linked to the recent prominence of terrorism concerns in these countries, as reflected also by the significant proportion of articles from HIC specifically on the topic of terrorism (10.6%). Paradoxically, there were few articles from either setting on industrial disasters as well as major transport accidents, the latter being a considerable global cause of mortality.¹⁷¹⁸

Box 1 Exemplar Search strategy used (all notation refers to Ovid MEDLINE)

Business continuity

1. Disasters/pc†
2. (emergency response or emergency preparedness or emergency plan\$ or emergency operation plan\$ or disaster or major incident\$ or incident plan\$).ti,ab.
3. 1 or 2
4. (business continuity or organisational resilience or business interruption or adaptive capacity or strategic or coordination).ti,ab.
5. 3 and 4
6. limit 5 to yr="1990 -Current"

Hazard analysis

1. Disasters/pc
2. (emergency response or emergency preparedness or emergency plan\$ or emergency operation plan\$ or disaster or major incident\$ or incident plan\$).ti,ab.
3. 1 or 2
4. (hazard analysis or risk factor or risk assessment or forecasting simulation or modelling).ti,ab.
5. 3 and 4
6. limit 5 to yr="1990 -Current"

Capability assessment or maintenance

1. Disasters/pc
2. (emergency response or emergency preparedness or emergency plan\$ or emergency operation plan\$ or disaster or major incident\$ or incident plan\$).ti,ab.
3. 1 or 2
4. (capability assessment or capability maintenance or gap analysis or needs assessment or drill or simulation or preparedness training).ti,ab.
5. 3 and 4
6. limit 5 to yr="1990 -Current"

Recovery

1. Disasters/pc
2. (emergency response or emergency preparedness or emergency plan\$ or emergency operation plan\$ or disaster or major incident\$ or incident plan\$).ti,ab.
3. 1 or 2
4. (significant event analysis or serious untoward incident\$ or root cause analysis or debrief or organisational learning or rehabilitation).ti,ab.
5. 3 and 4
6. limit 5 to yr="1990 -Current"

Communications/informatics

1. Disasters/pc
2. (emergency response or emergency preparedness or emergency plan\$ or emergency operation plan\$ or disaster or major incident\$ or incident plan\$).ti,ab.
3. 1 or 2

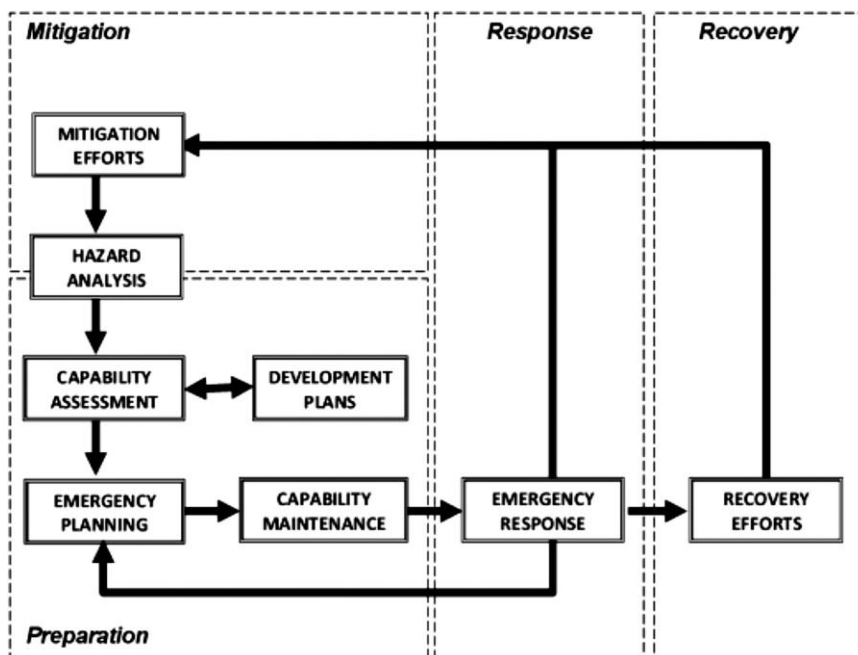
4. (communication\$ or mass media or public relations or information system\$ or information service\$).ti,ab.
5. 3 and 4
6. limit 5 to yr="1990 -Current"

Organisational behaviour

1. Disasters/pc
2. (emergency response or emergency preparedness or emergency plan\$ or emergency operation plan\$ or disaster or major incident\$ or incident plan\$).ti,ab.
3. 1 or 2
4. (community engagement or community involvement or participatory involvement or participatory engagement or consumer participation or organisational behaviour or health personnel or human resources).ti,ab.
5. *Attitude of Health Personnel"/
6. *Interprofessional Relations/
7. 4 or 5 or 6
8. 3 and 7
9. limit 8 to yr="1990 -Current"

tpc is the database notation for 'prevention and control', a subheading particularly relevant to the concept of planning.

Figure 1 Integrated Emergency Management System model.



Thematic category of publication

Overall, 60.8% of publications for HIC covered topics relevant to the Preparedness phase of the disaster management cycle that includes Emergency Planning, Capability Assessment and Maintenance as well as Development Planning to address identified gaps and weaknesses (figure 3, table 2). By contrast, only 29.2% of LMIC publications covered this. On the other hand, 52.2% of articles for LMIC settings covered Emergency Response issues compared with 32.8% of HIC publications. For both LMIC and HIC settings, the proportion of articles on Mitigation, covering both Mitigation and Hazard Analysis, were low (11.8 and 11.3%, respectively). Similarly, the proportion of articles on Recovery issues was also low, although more was published for LMIC settings (19.7%) than HIC settings (10.0%). A substantial proportion of articles covered crosscutting issues such as Communications, Informatics and Intelligence, for both LMIC (27.0%) and HIC (29.6%) settings.

DISCUSSION

This study is one of the first attempts to scope and map out the academic evidence base for disaster planning and management in the health sector for LMIC settings. In a previous scoping study, we noted that the evidence base for HIC settings is lacking, and we have found a similar deficiency for LMIC settings.⁹ Publications relating to disasters tend not to be coded well bibliographically with no universally agreed taxonomy. This probably reflects the different approaches to and understanding of disaster management concepts worldwide. This study therefore highlights the paucity of LMIC-based research and hence questions the robustness of the evidence base for current disaster planning and management.

We noted a contextual distinction between disaster management in HIC settings and LMIC settings. In HIC settings, the emphasis is very much on Emergency Preparedness, while in LMICs it is on Disaster Response. This could be because the latter tend to experience more disasters. Indeed, poorer communities are more vulnerable due to a lack of resources, infrastructure, knowledge or capacity to adequately plan and prepare for disasters. Indeed, over the past

decade there have been global policy shifts with a move towards more 'disaster risk reduction' activities in LMICs similar to HIC settings. Experience and expertise in the two different settings is not antagonistic but potentially offers learning opportunities in both directions.

There have been calls for more standardised reporting and investigation of disasters to inform future planning,^{19–21} as well as to consolidate learning from disasters.²² Various systems have been suggested to standardise methods of reporting,^{23 24} and attempts have been made to catalogue incidents internationally.²⁵ However, the knowledge base remains fragmented, owned by different organisations (not all of whom allow open access), and is not efficiently organised or used.²⁰ This situation persists despite efforts to address this knowledge management issue, such as the setting up of knowledge repositories for disaster management practitioners, for example, Reliefweb.²⁶

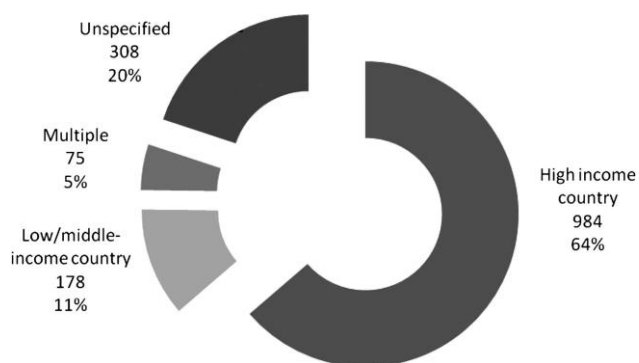


Figure 2 Setting of published articles on disaster management by country (n, %).

Table 1 Type and topic of publication on disaster management by country-setting

Setting	LMIC		High-income country	
	Number	Percent	Number	Percent
Publication type				
Event report/review	80	44.9	279	28.3
Commentary/editorial/letter	27	15.2	239	24.2
Literature review	1	0.6	20	2.0
Education	0	0.0	49	5.0
Expert guidance	14	7.9	51	5.2
Systematic review	1	0.6	4	0.4
Randomised controlled trial	0	0.0	2	0.2
Other research study	55	30.9	342	34.7
Type of disaster				
LMIC				
Natural disaster	117	65.7	204	20.7
Industrial disaster	2	1.1	26	2.6
Chemical/biological/radiological/nuclear	4	2.2	99	10.0
Conflict-related/war	2	1.1	8	0.8
Terrorism	4	2.2	105	10.6
Civil disturbance, riot, strife	3	1.7	7	0.7
Outbreaks, epidemics, pandemics	7	3.9	68	6.9
Major transport accidents	2	1.1	27	2.7
Generic	27	15.2	355	36.0
Multiple	8	4.5	62	6.3
Other	2	1.1	25	2.5
Total	178		986	

LMIC, low- and middle-income country.

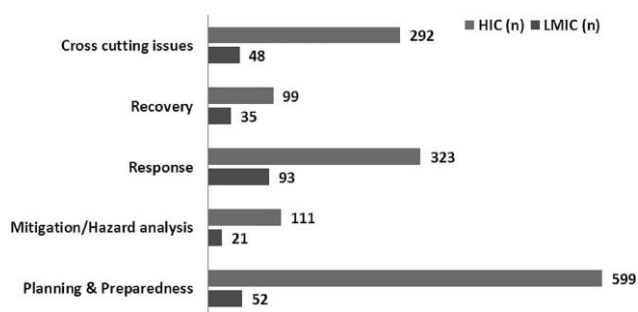


Figure 3 Articles by disaster management cycle phase.

Table 2 Thematic category of publication by country setting

Disaster management	Thematic category	LMIC		High-income country	
		Number	Percent	Number	Percent
Mitigation	Mitigation	6	3.4	33	3.3
	Hazard analysis	15	8.4	78	7.9
Preparedness	Capability assessment	14	7.9	132	13.4
	Emergency planning	18	10.1	527	53.4
	Capability maintenance	9	5.1	157	15.9
Response	Development plans	11	6.2	53	5.4
	Emergency response	93	52.2	323	32.8
Recovery	Recovery	35	19.7	99	10.0
Cross-cutting issues	Communications and the media	11	6.2	98	9.9
	Informatics and intelligence	11	6.2	94	9.5
	Other organisational issues	26	14.6	100	10.1

LMIC, low- and middle-income country.

We also observed that there were considerably more academic articles on this topic published for HIC than for LMIC settings, and that the published literature is disproportionately centred on North America.⁹ This could possibly reflect an indirect publication bias with many of these journals being published in HIC. It may also capture the effect of widespread federal funding for research into emergency planning in the wake of the September 11 terrorist attacks. It is questionable whether academic journals are the ideal vehicle for collating and disseminating the evidence base for disaster management in LMIC settings particularly when practitioners from these settings often experience barriers including limited access to educational resources, poor formal training and lack of continuing professional education.²⁷ However, the current grey literature repositories such as Reliefweb are not organised in a way that assists practitioners in identifying relevant sources for a particular type, or phase, of a disaster. Furthermore, the generic, non-specialist terminology used by such resources means that they may not catalogue documents in a manner that facilitates easy access and purposive retrieval. Finally, even if identified and subsequently retrieved, materials housed in such repositories may not benefit from stringent peer review.

The traditional 'gold standard' for research methods (ie, randomised controlled trials) as applied to clinical research is inappropriate and impractical in this field,⁸ except perhaps in very specific areas (eg, brief psychological intervention for survivors). Usual research practice often requires almost an antithesis to an emergency response situation, that is, it typically requires time for planning and resources for carrying it out at a time when both may be in short supply.

Furthermore, rigorous investigation requires a 'controlled' environment which may be unrealistic in disaster situations when the environment and infrastructure have been disrupted and are uncontrollable. Finally, the contextual nature of particular disasters may make it challenging to identify generalisable principles. Narrative synthesis of observational studies is possible but is hampered by the lack of consistent data collection.²⁸ While there are multiple event reports from disasters worldwide, we found no meta-synthesis of these published in academic journals to provide a robust evidence base. As such, there is a pressing need to encourage more research and reporting from disasters in LMIC as well as peer-reviewed publications to improve the quality and robustness of what is reported. Without an adequate evidence base of published research for LMIC settings, this will adversely affect the ability of evidence review initiatives, such as EvidenceAid, to generate robust and definitive answers.²⁹

We acknowledge that the heterogeneity of the literature base made the identification of all relevant articles challenging and it is not possible to guarantee that all relevant articles were identified. Our search strategy was therefore deliberately inclusive and is likely to have identified a large and representative sample of the published academic literature. Perhaps more significant is the fact that much of the literature on disaster planning and management in LMIC tends to be grey literature, or stored in knowledge repositories other than academic ones. Consequently, this study may not reflect the full evidence-base. Finally, we have used a thematic coding model based on the US IEMS and the transferability of this to LMIC settings could be challenged. That said, there is considerable overlap with other commonly used disaster management cycles (eg, Mitigation, Preparedness, Response and Recovery model), and the IEMS model offers the benefit of a wider range of coding categories.

Our findings have exposed the relative paucity of the academic evidence base available to assist health sector disaster planners, managers and policymakers. While our focus was on the health sector, we believe our findings are likely to be pertinent to disaster planning as a whole. We have also identified a preponderance of publications relating to emergency preparedness and response compared with those addressing mitigation and recovery, suggesting deficiencies in the published literature on the latter topics. A more balanced redistribution of research towards these two themes may therefore prove fruitful. Similarly, a disproportionate number of publications originate from the USA. The generalisability of US findings to the rest of the world is questionable, given national variations in legal frameworks and emergency response infrastructure. There is therefore a critical need to identify and define consensus areas perceived as priorities for research among those involved in the field, particularly those working in LMIC settings. It would also be beneficial to encourage more publications in academic journals not least for the quality assurance that peer review brings, but also for improving the accessibility of the material. Finally, there is insufficient research capacity and expertise to carry out research on disasters in LMICs at all levels, be it at the individual, organisational, national or regional levels. The development of local disaster research capacity is vital if we are to capture learning from disasters occurring in these settings.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The unpublished bibliography for the evidence review will be made publicly available by request to the corresponding author.

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