Disaster Medicine and Public Health Preparedness

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An Evidence Gap Map of Experience-based Evidence of Health Resource Allocation in Disaster and Humanitarian Settings

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Systematic Review

Cite this article: Horn ZB, Ranse J and Marshall AP (2024). An Evidence Gap Map of Experience-based Evidence of Health Resource Allocation in Disaster and Humanitarian Settings. *Disaster Medicine and Public Health Preparedness*, **18**, e136, 1–10
https://doi.org/10.1017/dmp.2024.103

Received: 29 August 2023
Revised: 17 April 2024
Accepted: 17 April 2024

Keywords:
disasters; surge capacity; resource allocation; disaster medicine; evidence gap

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Abstract

Objective: The aim of this review is to identify, evaluate, and graphically display gaps in the literature related to scarce health resource allocation in humanitarian aid settings.

Methods: A systematic search strategy was utilized in MEDLINE (via Ovid), Scopus, EMBASE, CINAHL Complete, and ProQuest Central. Articles were reviewed by 2 reviewers with a third reviewer remedying any screening conflicts. Articles meeting inclusion criteria underwent data extraction to facilitate evaluation of the scope, nature, and quality of experience-based evidence for health resource allocation in humanitarian settings. Finally, articles were mapped on a matrix to display evidence graphically.

Results: The search strategy identified 6093 individual sources, leaving 4000 for screening after removal of duplicates. Following full-text screening, 12 sources were included. Mapping extracted data according to surge capacity domains demonstrated that all 4 domains were reflected most of all the staff domain. Much of the identified data was presented without adhering to a clear structure or nomenclature. Finally, the mapping suggested potential incompleteness of surge capacity constructs in humanitarian response settings.

Conclusions: Through this review, we identified a gap in evidence available to address challenges associated with scarce resource allocation in humanitarian settings. In addition to presenting the distribution of existing literature, the review demonstrated the relevance of surge capacity and resource allocation principles underpinning the developed framework.

Disasters and humanitarian crises offer an extensive range of challenges for disaster responders and humanitarian actors. These settings frequently feature the necessity to operate despite political tensions, active armed conflict and violence, significant suffering and loss of life, and profound resource scarcity.[1] Resource scarcity can develop due to several key processes seen in the aftermath of disasters or during humanitarian crises, primarily through shifting the balance between demand for care and the availability of resources.

Resources essential for health-care delivery, according to surge capacity constructs, can be grouped into the following: staff, stuff, space, and systems.[2–4] Significant threats to or shortages within these domains similarly threaten the capacity of a health service to deliver care, thus precipitating or exacerbating disparities. For example, the surge capacity domain of space includes appropriate physical space equipped with the required infrastructure and equipment that can be directly damaged and threatened by events such as floods or earthquakes.[5–7] Additionally, the staff domain includes the number and skill sets of available personnel which can be directly and indirectly threatened by conflict, violence, and the brain-drain phenomenon, in which an exodus of experts seeking safety leaves a knowledge and skill gap while demand continues to grow.[7,8] It is, therefore, important to consider these domains and their relevance in the allocation of health resources.

The principles and practice of triage have evolved, but the primary function remains to provide mechanisms for distributing finite health-care resources.[9–10] Operationally, triage is the application of systems which rank individuals according to the urgency of care required, providing clinicians with a means of patient prioritization.[10–12] While deployed in the routine delivery of health-care services and in mass casualty incidents, traditional applications of triage can become saturated by an overwhelming number of patients in disaster and humanitarian crisis settings. Patient prioritization and health resource allocation in these settings therefore requires

different approaches to clinical decision-making, patient prioritization, and potentially even the categorical denial of clinical care in response to disparity between demand and availability.

Emerging resource allocation principles include, firstly, the level of allocation. In terms of level of allocation, there are 2 primary levels: (1) macro-allocation, representing determinations affecting the overall availability of resources for health service delivery,[13,14] and (2) micro-allocation, representing determinations affecting the allocation of a specific resource to an individual.[13,14] The second principle is the basis of triage, which can be grouped according to individual-based, where triage is concerned only with prioritizing or allocating resources to individuals, or population-based, in which the population context is considered in determining resource allocation.[15–17] The final principle considered is transparency, with subcategories of explicit determinations with formal and transparent means of allocation often underpinned by policy or procedures, or implicit decisions made by individuals on an ad hoc basis.[18,19]

Health resource allocation in disasters and humanitarian settings has been the subject of theoretical and conceptual debate and analysis, and there has been some exploration of the ethical challenges faced by health-care workers in these contexts; however, there are several significant barriers that exacerbate the limitations of established mechanisms of health resource allocation, as well as the translation of knowledge from hospital settings (even during disasters) and the humanitarian crisis context. This gap is further exacerbated by the present lack of a comprehensive exploration of the state of evidence derived from direct experience with negotiating triage practices and decision-making mechanisms in these settings.

Aim and Research Question

The aim of this review is to identify, evaluate, and display graphically relevant studies to clearly identify gaps in the existing literature related to scarce health resource allocation in humanitarian aid settings. In doing so, this review will answer the question "what evidence has been derived from experiences of managing health resource allocation in real-world settings requiring humanitarian aid?".

Methods

A mapping review utilizes a transparent and systematic approach to identifying, extracting, and mapping relevant literature according to an adopted framework.[20,21] A mapping review can be supplemented by an evidence gap map (EGM), which visually presents evidence according to the framework utilized in the mapping review, making evidence distribution and critical gaps rapidly and visually accessible to users.[20–23] The methodological approach to performing a mapping review and EGM is provided in the literature as follows: (1) develop the framework to underpin the search and resulting EGM, (2) establish inclusion criteria, (3) conduct search for literature, (4) screen and assess evidence for inclusion, (5) perform data coding, extraction, and appraisal, and (6) perform analysis and produce visual representation of data.[21–23]

Develop Framework

Developing a mapping review framework requires identification of categories, domains, and filters relevant to the central phenomenon.[21–23] The categories were determined *a priori* to be (1) key resource allocation principles and (2) the surge capacity construct. The resource allocation category informed row headings, with principle subcategories determining the domains: (1) level of allocation produced the domains of macro-allocation and micro-allocation, (2) basis of triage produced the domains of population-based and individual-based, and (3) transparency produced the domains of explicit and implicit. The surge capacity category informed the column headings, and these domains were determined to be staff, stuff, space, systems, and other/unspecified (added to ensure capture of relevant data not captured by these domains). This configuration served both as a theoretical framework underpinning this review and the framework informing the resulting EGM matrix. Finally, the primary filter for this mapping review was determined to be the "level of evidence."

Establish Inclusion Criteria

Inclusion criteria were determined to capture evidence derived from experience and pertaining to health resource allocation or surge capacity occurring in the disaster and/or humanitarian crisis setting. Although acceptable for systematic reviews to be included in mapping reviews and EGMs, the scarcity of focused research on this topic underpinned on a focus on structured primary research and unstructured experiential accounts (such as discussion papers, editorials, narrative accounts). Inclusion and exclusion criteria for this literature review are presented in Table 1. Of note, papers were still considered for inclusion if the experience was considered or analyzed according to specific ethical challenges experienced rather than presenting ethical commentary or theoretical ethical recommendations.

Conduct Search for Literature

A systematic search was undertaken, guided by the Preferred Reporting Items of Systematic review and Meta-Analysis (PRISMA) guidelines.[24] Databases and search engines searched included MEDLINE (Medline Industries, Inc; Mundelein, Illinois, USA) via OvidSP (Ovid Technologies; New York, New York, USA), Scopus (Elsevier; Amsterdam, Netherlands), Embase (Elsevier; Amsterdam, Netherlands), CINAHL Complete (EBSCO Information Services; Ipswich, Massachusetts, USA), and ProQuest Central (Clarivate; Ann Arbor, Michigan, USA). The search strategy

Table 1. Inclusion and exclusion criteria for article screening

Inclusion criteria	Exclusion criteria
Context/setting: • Health resource allocation, surge capacity; AND • Disaster and/or humanitarian crisis setting; AND • Discuss or be focused on experience Publication type: • Primary research (Qual, Quan, MM); • Discussion paper, editorial or opinion; • Experiential account (narrative, structured, or unstructured) Language: • English version must be available	Context/setting: • Disaster or crisis requiring local response only (i.e., no national or external assistance required in response) Publication type: • Conference abstract; • Ethical analysis/critique (including hypothetical); • Systematic review, integrative review, meta–analysis, scoping review, literature review Focus: • Does not feature resource allocation, care delivery

Qual, qualitative methods; Quan, quantitative methods; MM, mixed methods.

https://doi.org/10.1017/dmp.2024.103 Published online by Cambridge University Press

Table 2. Search terms used during systematic database search

MEDLINE	Scopus	EMBASE	CINAHL Complete	ProQuest Central
Disasters	Disaster*	**Disaster**	Disaster*	Disaster*
Relief work	Relief work	**Relief work**	Relief work	Relief work
Disaster victim	Disaster victim*	**Disaster victim**	Disaster victim*	Disaster victim*
Red Cross	Disaster medicine	**Disaster medicine**	Disaster medicine	Disaster medicine
Disaster medicine	Military medicine*	**Military medicine**	Military medicine	Military medicine
Military medicine	Complex human emergenc*	Complex human emergency	Complex human emergenc*	Complex human emergenc*
United Nations	Complex emergenc*	Complex emergency	Complex emergenc*	Complex emergenc*
World Health Organization	Humanitarian aid	**Humanitarian aid**	Humanitarian aid	Humanitarian aid
Complex human emergenc*	Humanitarian cris*	**Humanitarian crisis**	Humanitarian cris*	Humanitarian cris*
Complex emergenc*				
Austere				
Humanitarian aid				
Humanitarian cris*				
Health care rationing	Health care ration*	Health care ration*	Health care ration*	Health care ration*
Resource allocation	Health* ration*	Health* ration*	Health* ration*	Health* ration*
Health resources	Resource allocation	**Resource allocation**	Resource allocation	Resource allocation
Surge capacity	Health resource*	Health resource*	Health resource*	Health resource*
Patient selection	Surge capacity	**Surge capacity**	Surge capacity	Surge capacity
Health* resource scarcity	Patient selection	**Patient selection**	Patient selection	Patient selection
Scarce resource*	Health* resource scarcity	Health* resource scarcity	Health* resource scarcity	Health* resource scarcity
Care ration*	Scarce resource*	Scarce resource*	Scarce resource*	Scarce resource*
Triage	Care ration*	Care ration*	Care ration*	Care ration*
Triage	Triage	**Patient Triage**	Triage	Health* personnel
Health personnel	Health* personnel	**Health care personnel**	Health* personnel	Health* worker*
Health workforce	Health* worker*		Health* worker*	Health* workforce
Health* worker*	Health* workforce		Health* workforce	
Experience*	Experience*	Experience*	Experience*	Experience*
Observation*	Observation*	Observation*	Observation*	Observation*
Understanding*	Understanding*	Understanding*	Understanding*	Understanding*
Opinion*	Opinion*	Opinion*	Opinion*	Opinion*
Belief*	Belief*	Belief*	Belief*	Belief*
Perception*	Perception*	Perception*	Perception*	Perception*
Perspective*	Perspective*	Perspective*	Perspective*	Perspective*
Impression*	Impression*	Impression*	Impression*	Impression*
Reflecti*	Reflecti*	Reflecti*	Reflecti*	Reflecti*
Phenomeno*	Phenomeno*	Phenomeno*	Phenomeno*	Phenomeno*

Search terms in **bold** are indexing terms relevant to the database (MeSH terms in Medline, and Emtree Controlled Vocabulary in Embase); *designates actual use of the wildcard operator.

included combinations of Medical Subject Headings (MeSH) terms and keywords, as outlined in Table 2. Terms and keywords within cells were combined using the OR Boolean operator, and cells within columns were combined using the AND Boolean operator. The search was run on November 22, 2022.

Article screening

Identified articles were imported into Covidence (Covidence; Melbourne, Australia) to facilitate screening. Each article was screened by title and abstract by 2 authors, with disagreements resolved by the third author. Those papers included by title and abstract had their full text reviewed by 2 authors with any disagreements during full review resolved by consultation between all authors.

Data Coding, Extraction, and Appraisal

Data were extracted from the reviewed articles into data extraction tables. Key information extracted included author(s), event description (external references were sourced to ensure an adequate description was provided if not described in sufficient detail within the article), response description, research focus and design, limitations, and an assessment of the level of evidence. The level of evidence was assessed according to the 7-tier hierarchy of evidence provided by Polit and Beck.[25] This hierarchy was utilized, as it goes beyond the scope of evidence typical of biomedical experimentation to include qualitative and descriptive methodologies (level VI evidence) and evidence derived from opinion and committee (level VII evidence).[25]

Data in the form of direct excerpts from articles which offered a meaningful contribution were also extracted into data tables. Each extract was then considered and classified according to its relevance within the framework in a binary manner in that each statement either was or was not relevant to each domain. Importantly, data were not extracted for congruence with these domains but rather were only considered according to the domains once already extracted and determined to be relevant.

Analysis and Evidence Gap Map Production

The EGM matrix was produced in direct response to the developed framework. Extracted data were aggregated to produce a binary result for each domain intersection according to resource (presence or absence). Data was plotted on the matrix according to the level of evidence filter and scaled according to the prominence of the data within each domain intersection.

Although not typical of a mapping review and EGM, data analysis in this review was supplemented by high-level content analysis of data within domains; however, a comprehensive

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synthesis remains outside the scope of this review. Themes were taken directly from the developed framework, so overarching themes are identical to the "categories" included in the mapping review framework.

Results

In total, 12 papers met the criteria for inclusion (Figure 1). Data extracted to inform this literature review are displayed in Table 3 and Table 4. The produced EGM (Figure 2) presents the included sources mapped according to how data extracted from each source related to surge capacity domains and the identified principles.

The papers vary in depth of detail relating to health resource allocation in humanitarian settings. There are several key points related to the nature of the data gathered. The reviewed papers did not utilize approaches to structuring or reporting their findings that supported standardizing this type of disaster and humanitarian research. Much of the extracted data represented only superficial consideration and lacked purposeful in-depth exploration of resource allocation. Finally, much of the extracted data were not produced with the intent to report on how decision-making occurred in these settings; for example, data extracted from numerous papers were derived from explorations of ethical, or even broader, challenges in humanitarian contexts.

All 4 surge capacity domains were represented by extracted data. The most represented of the 4 surge capacity domains was the staff domain, with data derived from 8 (67%) of the included papers. The least represented was the space domain, with data derived from only 3 (25%) papers. Both the stuff and systems domains were informed by data extracted from 6 (50%) sources each. Data from 10 (83%) papers were assigned to the unspecified category, particularly prominent across the basis of triage and transparency themes, after the extract could not be otherwise classified.

Level of Allocation

Data extracted from 11 (92%) sources related to the level of allocation. Of all included sources, data from 9 (75%) papers related to macro-allocation and data from 10 (83%) papers related to micro-allocation. Across the surge capacity domains, the staff domain was most prominent within this theme, with equal distribution of sources across the macro-allocation and micro-allocation subthemes. Of note, level of allocation is the only theme in which the space domain was addressed across both subthemes.

Extracted data related to macro-allocation or decisions determining the overall availability of resources[13,14] noted high-level directives and mandates,[26,27] donor fatigue and donor influence,[26–29] tensions felt by in-field operators due to external determinations,[28,30] decisions prioritizing risk mitigation,[27] and decisions prioritizing impact maximisation[30–32]. Data related to micro-allocation, or decisions determining allocation of resources to individuals,[13,14] noted the influence of external factors on resource allocation, such as organizational priorities and policies[29,30,33,34] and the balance of risk,[35] and the prioritization of survival or at least greatest impact.[27,31,32,36,37]

Basis of Triage

Data extracted from all 12 sources related to the level of allocation, with data from 12 (100%) papers related to population-based triage and data from 5 (42%) papers related to individual-based triage; however, when considering only data assigned to surge capacity domains, this reduced to 10 (83%) and 3 (25%) papers, respectively. Despite all papers contributing data to this theme, it remained

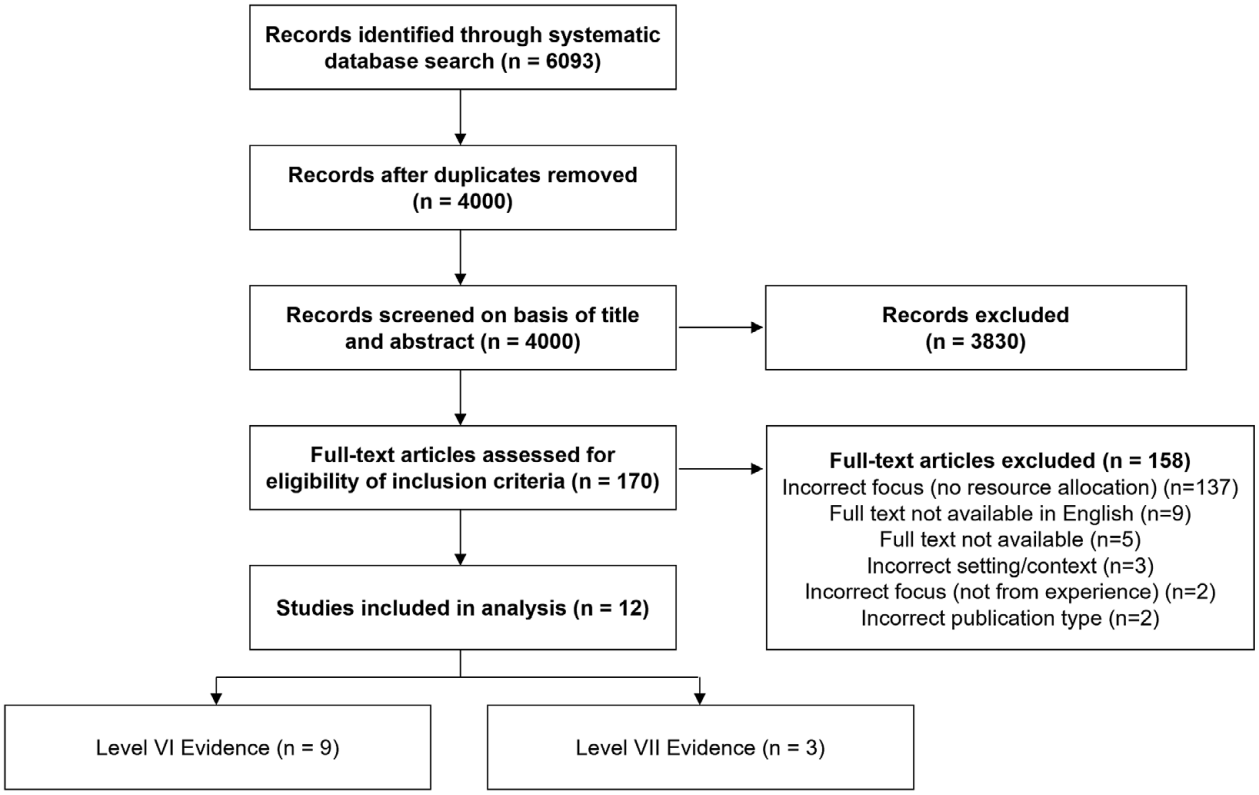

Figure 1. Modified PRISMA flow diagram.

https://doi.org/10.1017/dmp.2024.103 Published online by Cambridge University Press

Table 3. Data extraction – description of context, event, and response

Authors, year	Event, setting, or context	Event description	Response type
Akik et al.,[26] 2020	Protracted Crisis (CHE) in Syria	Complex crisis starting in March 2011 by an uprising followed by sustained conflict and violence, population displacement, collapse of public health and health care services, and marked shifts in political boundaries.	Multiple agencies/response formats involved in the delivery of reproductive, maternity, neonatal, child and adolescent health, and nutritional care. Agency types represented: UN agency, international NGO, local NGO, local health authorities, and academia. Hubs represented: Syria (whole), Damascus, Jordan, and Turkey.
Asgary & Lawrence,[28] 2020	Supervisory experience in humanitarian responses	Very broad representation of humanitarian responses; however, mostly unspecified.	Multiple agencies/response formats involved in the delivery of humanitarian aid/response. Agency types represented: United Nations Agencies, World Health Organization, International NGOs, and International governmental organizations. Very broad representation of international humanitarian recipient locations.
Cereste,[33] 2011	2007 Military Surge in Balad, Iraq	The 2007 Surge is the term applied to the deployment of 30,000 United States military personnel, including 5 battalions, by the Bush Administration, stating an objective of establishing regional stability. The Surge lasted 17 months.[54]	United States Air Force deployment in a military capacity. Author was deployed as a trauma intensive care physician to work in the trauma hospital in Balad, Iraq which served both the military and local non–military populations.
Civaner, Vatansever & Pala,[30] 2017	Experiences in disasters in Turkey	Disasters represented: earthquakes, floods, avalanches, industrial accidents, explosions, armed conflict, refugee camps, and mass gatherings.	Responses varied in nature depending on the event triggering the response. All participants belonged to the Turkish Medical Association and Ministry of Health.
Daniel,[34] 2012	2010 Haiti Earthquake	Magnitude 7.0 earthquake in Republic of Haiti on January 12 2010. 80–90% destructions of buildings near epicenter in city of Leogane with significant destruction in the Port–au–Prince metropolitan region.[55]	International non–profit public health organization. Author was deployed to the University Hospital in Port–au–Prince to work in a clinical capacity. Duration of participation not specified.
Drevin et al.,[35] 2019	2014–15 Ebola Virus outbreak, Sierra Leone	West Africa Ebola Virus Disease epidemic first identified in Guinea as of March 2014. The first region in Sierra Leone to be declared Ebola–free (January 2015) was the Pujehm District.[56,57]	Study focused on response of public hospitals in the region where obstetric surgical procedures were performed during the Ebola Virus outbreak. Identified facilities continued to perform obstetric surgery during the hemorrhagic viral disease outbreak.
Durocher et al.,[27] 2017	2010 Haiti Earthquake	Magnitude 7.0 earthquake in Republic of Haiti on January 12 2010. 80–90% destructions of buildings near epicenter in city of Leogane with significant destruction in the Port–au–Prince metropolitan region.[55]	Multi–organization response to deliver health care to individuals affected by the earthquake. Agency types represented: government officials, local healthcare workers, international and national NGOs.
Fardousi, Douedari & Howard,[36] 2019	Besiegement of Aleppo and Damascus, Syria	Complex crisis starting in March 2011 by an uprising followed by sustained conflict and violence, population displacement, collapse of public health and health care services, and marked shifts in political boundaries. Specifically, study focuses on besiegement of Aleppo (2016) and Ghouta, Damascus, (2013–2018) by government and non–government military forces.	Marked international response. Study explored the response of in–situ (local) healthcare staff who continued to deliver, and service–users who utilized, healthcare services during the besiegement.
Hunt et al.,[29] 2020	Humanitarian Settings (non–specified)	Very broad representation of humanitarian responses; however, mostly unspecified.	Broad representation of agency/response formats including national and international NGOs (from global to local levels); however, specific responses were not further specified.
Kreiss et al.,[31] 2010	2010 Haiti Earthquake	Magnitude 7.0 earthquake in Republic of Haiti on January 12 2010. 80–90% destructions of buildings near epicenter in city of Leogane with significant destruction in the Port–au–Prince metropolitan region.[55]	Israeli Defence Force Field Hospital 10–day deployment to deliver health care addressing needs in the affected region (medical, surgical, orthopaedic, pediatric, gynecologic, and ambulatory care). The Field Hospital deploys as a stand–alone health care facility which partners locally to establish referral chains.
Lamblin et al.,[32] 2021	Operation Barkhane – Health facilities in Mali and Chad	Operation Barkhane (from August 2014) was a military operation aimed at developing multifaceted regional security capability against a rising threat of terrorism and non–government military action.	The French Military led Operation Barkhane and contributed health personnel to provide medical support in the capacity of general practice, paramedicine, and damage control surgery. This included the provision of medical assistance to civilians in Mali and Chad.
Sloand et al.,[37] 2013	2010 Haiti Earthquake	Magnitude 7.0 earthquake near Port–au–Prince in the Republic of Haiti in 2010. The earthquake occurred on a backdrop featuring poverty, fragility, and political instability.	Study focuses on the experiences of those involved in 2 responses: (1) working in Port–au–Prince in the capacity of a volunteer nurse; or (2) working on the United States Naval Ship (USNS) Comfort in the capacity of a nurse.

Table 4. Data extraction – research focus, design, limitations, and level of evidence

Authors	Research focus	Design	Limitations	Level of evidence
Akik et al.,[26] 2020	Reproductive, maternity, neonatal, child and adolescent health, and nutritional care delivery	Descriptive desk review of routinely collected data, Qualitative interviews with 25 healthcare decision–makers	Single–focus study with a narrow scope of health care delivery.	VI
Asgary & Lawrence,[28] 2020	Ethical considerations and challenges in humanitarian situations	Descriptive qualitative comprehensive semi–structured interviews with 44 humanitarian aid workers	Did not clearly identify or report the nature of the crises/events being responded to. Exploration focused on ethical considerations rather than decision–making.	VI
Cereste,[33] 2011	Experience of delivering health care in resource–constrained combat settings	Independent individual experiential account of a health care worker	Reports the reflections of a single individual. Conceptual limitations given the context of the explored experience being aligned with an active military force.	VII
Civaner, Vatansever & Pala,[30] 2017	Disaster training and experience, and ethical problems encountered in disasters	In–depth interviews with 31 health care workers underpinned by Grounded Theory	Reports the experience of health care workers without specifying the nature of the disaster response. All disasters occurred within 1 geographical region.	VI
Daniel,[34] 2012	Resource allocation decision–making among 4 patients in relation to oxygen therapy	Individual experiential accounts of a health care worker via reflective narrative	Reports the reflections of a single individual considering the allocation of a single resource among 4 patients at a snapshot of time.	VII
Drevin et al.,[35] 2019	Motivation and decision–making underpinning the performance of caesarean sections during an Ebola Virus outbreak	Qualitative, semi–structured interviews with 15 obstetric surgical care providers	Reports experiences specific to the delivery of a single service type in a single disaster context.	VI
Durocher et al.,[27] 2017	Ethical questions arising from humanitarian responses to the 2010 Haiti Earthquake	Descriptive interpretive, semi–structured in–depth interviews with 24 healthcare workers and decision–makers	Reports on a large–scale response to a prominent disaster; however, the research focus in ethical questions arising from, rather than the experience of navigating, scarce resource management.	VI
Fardousi, Douedari & Howard,[36] 2019	Security, mass casualty, and scarce resource management in conflict	Qualitative, semi–structured interviews with 21 Syrian health care workers and service users	Reports on the experience of national/local staff managing a sustained crisis without	VI
Hunt et al.,[29] 2020	Obstacles to providing palliative care in humanitarian settings	Exploratory qualitative, semi–structured interviews with 24 humanitarian health professionals and policymakers	Reports on a narrow health care focus with limited reporting of disasters and nature of responses that participants were drawn from.	VI
Kreiss et al.,[31] 2010	Experience of Israeli Defence Force Field Hospital delivering care with constrained resources	Joint descriptive account of collective experience	Reports the recollection and reflections of the authors who shared an experience of responding to a single event from a single facility.	VII
Lamblin et al.,[32] 2021	Ethical dilemmas experienced by French military doctors in overseas operations	Observational qualitative, semi–structured interviews with 20 French doctors in overseas operations	Reports on the experience of military doctors engaged in health care during military operations and, thus, experiences are influenced by factors external to a humanitarian response.	VI
Sloand et al.,[37] 2013	Experience of volunteer nurses who responded locally in Port–au–Prince or on–board USNS Comfort following the 2010 earthquake	Semi–structured interviews with 12 American nurses who volunteered	Reports on experiences of only 1 specific professional subset of responders.	VI

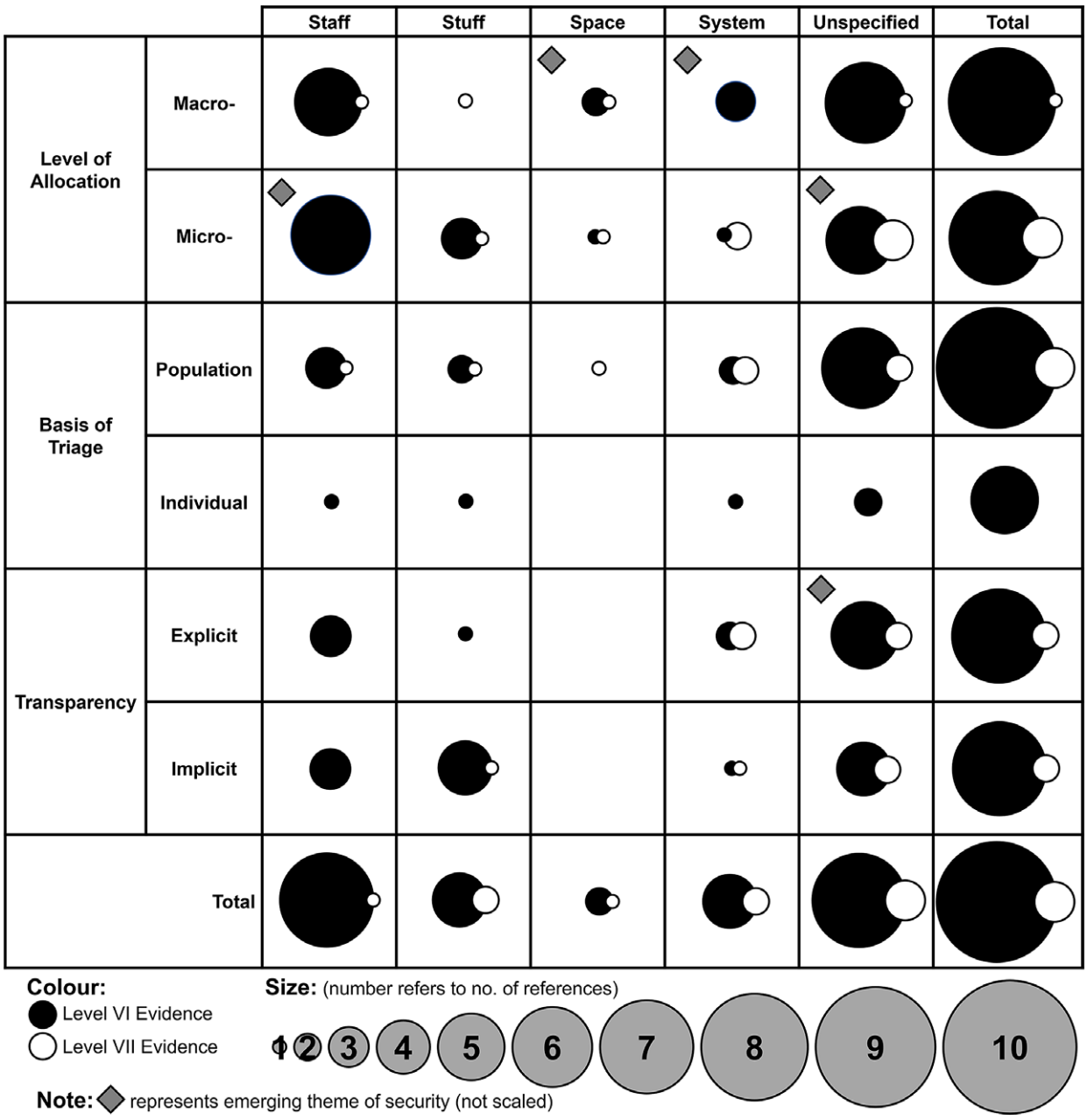

Figure 2. Evidence Gap Map.

grossly underrepresented compared to the other 2 themes. Of additional note is that the space domain consisted of data from only 1 (8%) paper which, notably, reported only level VII evidence.

The basis of triage was considered according to whether decisions are concerned with allocating resources to individuals according to individual characteristics (individual) or according to the broader population context (population-based).[15–17] When considering the population context, the included sources noted defining the "population" by need or vulnerability,[26,28] military affiliation,[32,33] or infection status.[30] Where individual clinical status alone was not sufficient to drive allocation decisions, it was noted that broader population perspectives became relied upon,[34] such as the use of the expectant category to clearly denote assessment and acceptance of clinical futility.[30,33]

Transparency

Data extracted from 11 (92%) sources related to the theme of transparency. Both explicit and implicit decision-making subthemes contained data extracts from 9 (75%) of the included sources. Including only data which related to the 4 surge capacity domains, both the explicit and implicit subthemes contained data from 7 (58%) papers. The most prominent domains in the explicit subtheme were staff and systems, while in the implicit subtheme, staff and stuff were the most prominent. Notably, no extracted data related to the space domain within this theme.

Explicit decision-making occurs particularly when the interest of donors must be considered[26] and when the outcomes must align with organizational mandates.[27] By comparison, implicit decision-

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making was noted to occur when balancing patient-versus-patient decisions.[33] Explicit decision-making was noted to be informed by rules and professional standards,[28,30,33] while implicit decision-making without these inputs is more prone to individual critique.[29,30] Data hinted at a point where the transition from explicit to implicit rationing becomes necessitated, particularly with implicit decision-making becoming increasingly dominant in the absence of operationalizable guidelines[28,29] or when decision-making is less straightforward.[32,34,35]

Security

During analysis, "security" emerged from within already extracted and otherwise classified data as a potential theme. Extracts related to security contained references to the selection of health-care facilities, the adoption of dispersed models of health delivery, decisions made in light of security threats to personnel, and the inability to treat patients in settings where security had become questionable.[26,32,36] Specifically, security emerged from data classified according to the following: staff (micro-allocation), space (macro-allocation), system (macro-allocation), and unspecified (micro-allocation, explicit).

Level of Evidence

Level of evidence is assessed and reported in accordance with the hierarchy of evidence provided by Polit and Beck.[25] Of the included papers, 9 (75%) reported level VI evidence or data gained by a single descriptive or qualitative research approach. The remaining 3 (25%) contained level VII evidence, consisting of data derived from unstructured reflection or opinion. Among the level VII papers, 2 (66%) contributed to the stuff and systems domains and 1 (33%) contributed to the staff and space domains.

Limitations

Firstly, many humanitarian crises occur in non-English-speaking regions, and thus, accounts and experience-based research may not be published or identifiable in English. Secondly, while a systematic search approach was deployed, it cannot be guaranteed that all potentially relevant sources have been captured. Additionally, the scarcity of data in this area meant there was insufficient data to perform a rigorous meta-synthesis, compounded further by the overall low level of evidence identified; however, the level of evidence must be considered in the context of humanitarian health-care settings and expectations around higher levels of evidence scaled by methodological and ethical feasibility.

Discussion

The aim of this review was to identify and produce an evidence gap map of the existing literature related to scarce health resource allocation in humanitarian aid settings. Overall, a limited and superficial body of experience-based evidence was available to inform this complex phenomenon in humanitarian settings.

There are several key frameworks available to underpin and guide disaster health research; however, there is no widely accepted framework or nomenclature system promoted specifically in relation to health resource allocation in these settings. The conceptual framework provided by Birnbaum et al.,[38] as a leading framework in disaster health research, details the progression from a hazard through to the requirement for a relief phase, providing a backbone for conceptualizing the role of disaster health interventions. However, in its current form, this collection of frameworks does not extend to address the nature and impacts of resource scarcity during health responses to disasters. This review, particularly with its focus on the intersection of surge capacity models and health resource allocation, creates and occupies a space not currently captured or explored conceptually within existing literature.

Surge Capacity Models: Hospital Versus Humanitarian Settings

Despite recent advancements in surge capacity models for health services, such models are yet to be formalized within the humanitarian landscape. Developed primarily as conceptual models addressing surges in hospital-based care settings, existing surge capacity models consist of 4 domains: staff, stuff, space, and systems.[2,3,39] The COVID-19 pandemic saw surge capacity models operationalized and clinicians reporting strategies employed to enhance the capacity of their health services. For example, Cammarota et al.,[40] Al Mutair et al.,[41] Gauss et al.,[42] and Rosenbaum[43] each contributed to either the conceptual or pragmatic advancement of surge capacity operationalization during the COVID-19 pandemic; however, surge capacity models seemingly remain the exclusive realm of hospital-based services aiming to enhance capacity from a functional baseline to accommodate further demand.

Despite contextual differences between the hospital-based settings within which existing surge capacity domains have been developed and humanitarian response settings, this review demonstrates the applicability of surge capacity domains within previous humanitarian health-care operations. Extracted data were amenable to inductive coding according to the surge capacity domains, with data consisting of experiences or strategies relevant to either individual or multiple domains. In this review, we therefore not only map existing literature according to this conceptualization but also establish the relevance of the framework developed to underpin the resulting EGM matrix. Additionally, the demonstrated utility of surge capacity models in response to the COVID-19 pandemic adds further weight to the potential contribution that further development and refinement of surge capacity models may have for humanitarian health responses.

Security as an Emerging Theme

Although the aim and nature of a mapping review and EGM is not to provide a meta-synthesis of available data, the theme of "security" emerged from data already inductively coded according to preexisting surge capacity domains. As already highlighted, the existing surge capacity model has been developed in hospital-based settings with a focus on the continuation of services above a secured operational baseline, a characteristic often incongruent with humanitarian health-care responses. When considering the 4 S's of surge capacity, each domain is traditionally considered according to whether there is a sufficient supply within each domain; however, the way in which "security" seems to cut across domains suggests additional factors and complexities relevant to humanitarian contexts not captured by the existing 4-domain model. Therefore, in addition to establishing the applicability of such models in the humanitarian space, this review also rapidly identifies that further work is required to conceptually and pragmatically refine a model fit for purpose in these settings.

https://doi.org/10.1017/dmp.2024.103 Published online by Cambridge University Press

Resource Allocation

The COVID-19 pandemic casts a spotlight on the concept of population-based triage, but developments continue to fall short of facilitating the translation of constructs to humanitarian settings. Despite its potential, population-based triage remains seemingly limited to infectious disease outbreaks, as demonstrated by formal attempts to operationalize population-based triage focusing primarily on ventilator scarcity during outbreaks of respiratory viruses.[44–48] For many international health systems, the COVID-19 pandemic highlighted the shortcomings of standard triage practices, sparking discussion around population-based triage; however, contributions in the form of protocols or guidelines[49–53] remain specific to the scope of pandemic responses alone.

Through this review, we confirm the relevance of population-based triage approaches beyond the scope of pandemics through inductive coding, and a scarcity of available literature specific to the humanitarian landscape is also demonstrated. The ongoing significance of this scarcity rests alongside the inability to translate existing constructs from pandemic to non-pandemic settings and, thus, capitalize on the surge in pandemic-related outputs to address this gap. Therefore, we recommend that further research into the nature and operationalization of population-based triage and, more broadly, resource allocation principles is required specifically in the humanitarian health response.

Conclusion

Through undertaking this systematic review and EGM, we have identified and graphically displayed existing experience-based research in relation to the allocation of scarce health resources in humanitarian settings. Among the identified sources, data frequently related sufficiently to justify extraction and analysis but were not derived with explicit intent to contribute to this research area. Data extracts could be mapped across all surge capacity domains, although a large proportion of data could not be classified accordingly. In addition to identifying areas of scarcity, data analysis and mapping identified an emerging theme of "security" as a potentially necessary addition to existing models of surge capacity when translated to humanitarian settings. Adopting surge capacity models in humanitarian health-care research may provide a potential way forward in terms of reporting, collating, and maximizing the translation experiences and findings.

Author contribution. Zachary Horn – systematic search of literature, screening of articles (title and abstract, and full-text review), data extraction, data analysis, production of evidence gap map graphic, and manuscript drafting.

Jamie Ranse – screening of articles (title and abstract, and full-text review), manuscript editing and review, and supervision of doctoral candidate.

Andrea Marshall – screening of articles (title and abstract, and full-text review), manuscript editing and review, and supervision of doctoral candidate.

Funding statement. This research was supported by an Australian Government Research Training Program (RTP) Scholarship.

Competing interest. None.

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https://doi.org/10.1017/dmp.2024.103 Published online by Cambridge University Press