

SPECIAL CONTRIBUTIONS

Global Emergency Medicine: A Review of the Literature From 2014

Torben K. Becker, MD, Susan Bartels, MD, MPH, Bhakti Hansoti, MBChB, MPH, Gabrielle A. Jacquet, MD, MPH, Kevin Lunney, MD, PhD, Regan Marsh, MD, MPH, Maxwell Osei-Ampofo, MBChB, MBA, MGCS (EM), MPH, Christopher Lam, and Adam C. Levine, MD, MPH, on behalf of the Global Emergency Medicine Literature Review (GEMLR) Group*

Abstract

Objectives: The Global Emergency Medicine Literature Review (GEMLR) conducts an annual search of peer-reviewed and gray literature relevant to global emergency medicine (EM) to identify, review, and disseminate the most important new research in this field to a worldwide audience of academics and clinical practitioners.

Methods: This year 6,376 articles written in six languages were identified by our search. These articles were distributed among 20 reviewers for initial screening based on their relevance to the field of global EM. An additional two reviewers searched the gray literature. A total of 477 articles were deemed appropriate by at least one reviewer and approved by the editor for formal scoring of overall quality and importance.

Results: Of the 477 articles that met our predetermined inclusion criteria, 63% were categorized as emergency care in resource-limited settings, 13% as EM development, and 23% as disaster and humanitarian response. Twenty-five articles received scores of 17.5 or higher and were selected for formal summary and critique. Inter-rater reliability for two reviewers using our scoring system was good, with an intraclass correlation coefficient of 0.657 (95% confidence interval = 0.589 to 0.713). Studies and reviews focusing on infectious diseases, trauma, and the diagnosis and treatment of diseases common in resource-limited settings represented the majority of articles selected for final review.

Conclusions: In 2014, there were fewer total articles, but a slightly higher absolute number of articles screening in for formal scoring, when compared to the 2013 review. The number of EM development articles decreased, while the number of disaster and humanitarian response articles increased. As in prior years, the majority of articles focused on infectious diseases and trauma.

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The Global Emergency Medicine Literature Review (GEMLR) strives to ensure that emergency care providers have access to the most current and important research conducted on relevant topics around

the world. GEMLR began 10 years ago in an attempt to identify and consolidate the relevant global emergency medicine (EM) literature into a format that is readily available to academics and practitioners.¹⁻⁹ This year,

From the Department of Emergency Medicine, University of Michigan (TKB), Ann Arbor, MI; the Department of Emergency Medicine, Queen's University (SB), Kingston, Ontario, Canada; Harvard Humanitarian Initiative (SB), Cambridge, MA; the Department of Emergency Medicine, Johns Hopkins University (BH), Baltimore, MD; the Department of Emergency Medicine, Boston University School of Medicine, and Boston University Center for Global Health and Development (GAJ), Boston, MA; Medical Corps, US Navy, Department of Emergency Medicine, Navy Hospital Camp Lejeune (KL), Camp Lejeune, NC; the Department of Emergency Medicine, Brigham and Women's Hospital (RM), Boston, MA; Partners In Health (RM), Boston, MA; the Accident & Emergency Department, Komfo Anokye Teaching Hospital and Kwame Nkrumah University of Science and Technology (MO), Kumasi, Ghana; the Warren Alpert Medical School of Brown University (CL), Providence, RI; and the Department of Emergency Medicine, Warren Alpert Medical School of Brown University (ACL), Providence, RI.

*Global Emergency Medicine Literature Review (GEMLR) Group members are listed in Appendix A.

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Address for correspondence and reprints: Torben K. Becker, MD; e-mail: tbeckermd@gmail.com.

our panel of seasoned reviewers includes physicians from Canada, China, Germany, Ghana, Singapore, South Africa, the United Arab Emirates, the United Kingdom, and the United States.

This is also the fifth year that gray literature was included in our search strategy. Gray literature has been defined as any material produced by an organization whose primary function is not publication.¹⁰ Our goal in performing a gray literature search is to identify new global EM research conducted by government agencies, local or international nongovernment organizations, or other entities that may not have been published in peer-reviewed journals.

The primary goals of the review are to illustrate best practices, stimulate research, and promote further professionalization in the field of global EM through the identification of important new publications that focus on emergency care in the global context, including care provision in limited-resource settings, disaster and humanitarian response, and EM development. At the same time, it is important to note that GEMLR is not a formal systematic review or meta-analysis, as it does not aim to synthesize the published literature on a specific topic or research question. Instead, its goal is to identify the highest-quality and most relevant global EM research from around the globe and summarize it in a single, easy-to-use reference.

METHODS

Each year, the GEMLR editorial board revises a procedure manual that outlines in detail the methodology for its search, screening, scoring, and reviewing processes.¹¹ Because the GEMLR is not a research study, no prior ethical or institutional review board approval was sought for this article. There were nine editors, four advisors, one *Academic Emergency Medicine* representative, and 22 reviewers. As reviewers and editors were not blinded to the authors of the articles included in the review or their affiliations, both reviewers and editors were recused from scoring or reviewing any articles in which they may have been directly or indirectly involved.

The initial search was conducted in two blocks: the first from January 1 to August 31, 2014, and the second from September 1 to December 31, 2014. PubMed was used to search Medline for original research or review articles that contained at least one “global” search term and one “emergency medicine” search term (Table 1). Seven journals that publish a significant number of global EM articles from prior GEMLR reviews were “hand-searched,” and all articles from the 2014 calendar year were included in the review. This year, the following journals were included in the hand search: *Academic Emergency Medicine*, *African Journal of Emergency Medicine*, *Annals of Emergency Medicine*, *Bulletin of the World Health Organization*, *Emergency Medicine Journal*, *Prehospital and Disaster Medicine*, and *The Lancet*. Based on the linguistic capacity of our reviewers and editors, our search this year was limited to articles published in Arabic, English, Chinese, French, German, Hindi, Japanese, Italian, Kiswahili, Portuguese, Spanish, and Vietnamese. All studies were limited to human

Table 1
Search Terms

Emergency Medicine	Global
Emergency medicine	World health
Refugees	Developing countries
Emergency treatment	International
Relief work	Global
Rescue work	Tropical medicine
Acute disease	Third world
Humanitarian	Middle-income countries
Critical illness	Low-income countries
War	Resource-limited settings
Prehospital	
Conflict	
Triage	
Disasters	
Multiple trauma	
Injuries	
Internally displaced persons	
Emergencies	
Emergency medical services	
Resuscitation	
Critical care	
Sepsis	
Shock	

subjects only; news articles and letters were excluded. Articles that had been e-published ahead of print in 2013 and had thus been included in the 2013 review were also excluded. The total number of articles produced by our PubMed search for 2014 was 6,520: 6,376 English, 51 Spanish, 40 German, 36 French, eight Japanese, six Italian, and three Portuguese. The total number of articles produced by our hand search for 2014 was 3,246. The 9,766 articles produced by these two searches were divided among 20 reviewers for initial screening based on their relevance to the field of global EM. A total of 464 articles were selected for formal scoring of their overall quality and importance by at least one reviewer based on GEMLR’s screening criteria and approved by his or her editor.

For the gray literature search, we used a preidentified list of academic, government, and nongovernmental organizations known to be conducting global health research or investigations as part of their work (Table 2). Two reviewers were assigned to search the websites of these organizations for needs assessments, program monitoring, evaluation reports, topic reviews, white papers, conference proceedings, and other types of articles that met the predefined screening criteria for relevance to the field of global EM. Through our gray literature search process, we found 13 additional global EM research articles that met the inclusion criteria; these were combined with those identified by the Medline and hand search process to create a final database of 477 research articles for formal scoring.

Once selected for scoring, each full-text article was obtained and classified as either an original research or a review article. Two reviewers independently categorized each article as emergency care in resource-limited settings (ECRLS), EM development, or disaster and humanitarian response (DHR). ECRLS includes trauma care, acute medical care, triage, and prehospital care in low- and middle-income countries, or resource-limited

Table 2
Gray Literature Sources

Academic centers/think tanks
1. Global Health Council
2. Center for Global Development
3. The United Nations University
4. RAND Corporation
5. The Woodrow Wilson Center
6. The Bill and Melinda Gates Foundation
7. Center for Global Health Research/University of Toronto
8. Emergency Trauma Care Project
9. Centre for Research on the Epidemiology of Disasters (CRED)
NGOs, UN, and government agency websites
1. MEASURE Evaluation
2. MSF
3. Epicentre
4. International Rescue Committee
5. International Medical Corps
6. Oxfam International
7. Oxfam Great Britain
8. GIZ/GTZ
9. International Committee of the Red Cross
10. Centers for Disease Control and Prevention
11. World Health Organization
12. Humanitarian Practice Network
13. UN High Commission for Refugees
14. UN Development Program
15. Inter-Agency Standing Committee
16. UNICEF
17. JHPIEGO
GIZ/GTZ = Deutsche Gesellschaft für Internationale Zusammenarbeit; JHPIEGO = formerly Johns Hopkins Program for International Education in Gynecology and Obstetrics; MSF = Médecins Sans Frontières; NGO = nongovernmental organization; UN = United Nations; UNICEF = United Nations Children's Fund.

settings of high-income countries. EM development includes research on the development of EM as a specialty, EM educational programs, or emergency medical care systems outside of North America, regardless of the national income level. DHR includes research on the care of civilian populations in conflict; disaster mitigation, assessment, and response; and health care of refugees and internally displaced persons.

Each article was then independently scored by two reviewers using a predefined grading scale that assessed for clarity, design, ethics, importance, and impact. Each topical area was scored from 0 to 5, totaling a final score range from 0 to 20 (Table 3). The mean of the two scores was used as the final score for the article. Any article with a score difference between reviewers of greater than two standard deviations from the median score difference was rescored by an editor. The editor's score was then used as the final score for the article. Twenty-five articles had final scores of 17.5 or higher. These were selected for formal review and were then distributed to reviewers who produced summaries and critiques of each article.

RESULTS

Of the 477 articles that met our predetermined inclusion criteria, 63% were categorized as ECRLS, 13% as EM

development, and 23% as DHR. Approximately 72% of the articles were original research, while the remaining 28% were review articles.

The median final score for all articles was 12.5, ranging from 3 to 20. There was no significant difference in mean scores between original research (12.1) and review (12.7) articles ($p = 0.983$). The differences in mean scores between ECRLS (12.8), EM development (11.7), and DHR (11.4) articles were significant ($p = 0.0001$). Inter-rater reliability for reviewer scoring, measured using the intraclass correlation coefficient, was 0.657 (95% confidence interval = 0.589 to 0.713), considered "good" reliability in the literature.^{12,13}

The top 25 global EM articles for 2014 are listed in Table 4.¹⁴⁻³⁷ The complete database of all 477 global EM articles for 2014, as well as full summaries and critical analyses of the top 25 global EM articles of 2014 can be found in Data Supplements S1 and S2 (available as supporting information in the online version of this article).

Of the 25 articles selected for formal review, 19 (76%) were categorized as ECRLS, four (16%) as EM development, and two (8%) as DHR. Seventeen (68%) articles were original research manuscripts and eight (32%) were review articles.

DISCUSSION

Each year, the number of quality articles in the field grows significantly, and thus achieving the mission of the review becomes more challenging. The scope of global EM continues to stretch beyond its initial boundaries to include injury prevention, epidemiologic transition, and knowledge transfer. Communicable diseases, trauma epidemiology and prevention, and diagnosis and treatment of diseases common in resource-limited settings dominated the articles selected for final review.

In 2013, no gray literature articles met our criteria for full review. This year, two manuscripts from the gray literature search scored highly enough to be included in the final list of top articles presented in this paper.

The number of ECRLS articles screening in from 2014 remained stable when compared to 2013, but the number of DHR articles increased, while EM development articles decreased. However, in terms of the number of articles in each of the three categories scoring highly enough to be selected for full review, there were more ECRLS, but fewer DHR and EM development articles than prior years. Below we summarize some of the 2013 trends in global EM research based on our review.

Emergency Care in Resource-limited Settings

As in years past, the ECRLS category of articles remains the most represented among articles chosen for full review (76%). Jo et al.²² report results of a randomized crossover trial comparing the two-finger technique versus a new technique called over-the-head two-thumbs encircling technique for infant CPR. Nurses performed both techniques on manikins, and were noted to have greater depth of compressions and greater proportion of effective compressions, but a lower proportion of compressions with complete chest recoil, with

Table 3
Scoring Criteria

Original Research Article		Points	Review Articles	Points
Clarity			Clearly stated purpose for review	2
			Sufficient background provided	1
			Understandable to nonprofessional	1
			Clear language, appropriate use of tables and figures	1
Design	RCT or observational study with control group or a diagnostic study utilizing an appropriate criterion (gold) standard for comparison	2	Formal meta-analysis or systemic review (including studies with a control group)	2
	No bias in selection of subjects; attempts to limit bias	1	Study selection is clear and reproducible	1
	Adequate blinding of study subjects	1	Article selected by at least two blinded authors	1
	Correct statistical tests used for analysis	1	Data aggregated and/or analyzed appropriately	1
Ethics	Approved by IRB	2		
	Adheres to Declaration of Helsinki	1		
	Consent obtained or waived by IRB	1		
	Authors have no COI	1		
Importance	Results are generalizable to a variety of settings	2	Results are generalizable to a variety of settings	2
	Topic is important	2	Topic is important	2
Impact	Topic is clearly relevant to GEM	1	Topic is clearly relevant to GEM	1
	Recommendations can be implemented in developing countries	2	Recommendations are applicable across a wide range of different settings	2
	The intervention studied is cost-effective	1	The intervention studied is cost-effective	1
	NGOs, UN agencies, and other actors would likely change their practice if they were aware of this study	1	NGOs, UN agencies, and other actors would likely change their practice if they were aware of this study	1
	Study results likely to stimulate further research	1	Study results likely to stimulate further research	1

COI = conflict of interest; GEM = global emergency medicine; IRB = institutional review board; NGO = nongovernmental organization; RCT = randomized controlled trial; UN = United Nations.

the new technique. The participants also felt less fatigued with the new technique and found it technically easier to perform.

Based on the Middle East subset from the INTERHEART study, Gehani et al.¹⁷ and Ounpuu et al.³⁸ report that nine risk factors (tobacco use, ApoB/Apo1 ratio, psychosocial, abdominal obesity, diabetes, hypertension, lack of fruits and vegetables in the diet, lack of exercise, and tobacco consumption) constitute 97% of the population attributable risk of acute myocardial infarction in Middle Eastern countries.

Many Articles Were Centered on Infectious Disease Topics, With Several Studies Examining Malaria. Growing rates of artemisinin resistance in *Plasmodium falciparum* malaria in South East Asia are a major public health concern. Ashley et al.²⁵ attempted to map the extent and severity of resistance. They found that despite high prevalence of resistance, almost universal treatment success was still achieved with a longer 6-day course of artemisinin-based combination therapy.

At the same time, as the incidence of malaria continues to decrease in South East Asia and ease of its diagnosis improves, the appropriate diagnosis and management of nonmalarial febrile illness has become increasingly important. Mueller et al.³⁹ describe important aspects of nonmalarial febrile illness.

Another study by Maude et al.³⁶ examined levamisole as an adjunctive treatment for patients with severe

P. falciparum malaria. However, in this randomized controlled trial, levamisole did not provide any significant benefits when added to standard artesunate therapy.

Means et al.¹⁸ studied clinical and operational factors associated with inappropriate antibiotic use in malaria-positive patients in Uganda. Using data from another study that examined malaria management, they found that antibiotics were inappropriately prescribed to malaria patients 42% of the time. This practice is associated with patients under five years of age, nonphysician providers, and patient triage.

A Cochrane systematic review by Zani et al.¹⁹ reports that when compared to artemether-lumefantrine and artesunate plus mefloquine, dihydroartemisinin-piperaquine is as good or better at preventing treatment failure of *P. falciparum* malaria throughout Africa and Asia.

Sepsis is one of the leading global causes of death, especially in sub-Saharan Africa where infectious diseases and HIV are prevalent, and access to intensive care is very limited. Andrews et al.²⁷ performed a randomized controlled trial of a simplified protocol for the treatment of patients with severe sepsis in Zambia. There was a very high prevalence of HIV and tuberculosis. No benefit was found with protocolized care, and the study was stopped early due to increased mortality of patients with hypoxemic respiratory distress in the intervention group compared to the control group.

Chisti et al.²³ sought to identify factors associated with postdischarge mortality in children hospitalized

Table 4
GEMLR 2014 Articles

Category, First Author	Title	Journal
Emergency care in resource-limited settings		
Carrasco ²⁶ Chisti ²³	Predictive tools for severe dengue conforming to WHO 2009 criteria Postdischarge mortality in children with severe malnutrition and pneumonia in Bangladesh	<i>PLoS Negl Trop Dis</i> <i>PLOS ONE</i>
Ashley ²⁵ Zhao ¹⁴	Spread of artemisinin resistance in <i>P. falciparum</i> malaria Pulse oximetry with clinical assessment to screen for congenital heart disease in neonates in China	<i>N Engl J Med</i> <i>Lancet</i>
Mueller ³⁹	Acute undifferentiated febrile illness in rural Cambodia: a 3-year prospective observational study	<i>PLoS One</i>
Saccone ¹⁶	Antibiotic prophylaxis for term or near-term premature rupture of membranes: meta-analysis of randomized trial	<i>Am J Obstet Gynecol</i>
Maude ³⁶	Randomized controlled trial of levamisole hydrochloride as adjunctive therapy in severe falciparum malaria with high parasitemia	<i>J Infect Dis</i>
Duong ³⁵	Poor performance of the determine HIV-1/2 Ag/Ab combo fourth-generation rapid test for detection of acute infections in a National Household Survey in Swaziland	<i>J Clin Microbiol</i>
Gupta ³⁷	Burn management capacity in low and middle-income countries: a systematic review of 458 hospitals across 14 countries	<i>Int J Surg</i>
Zani ¹⁹	Dihydroartemisinin-piperaquine for treating uncomplicated <i>P. falciparum</i> malaria	<i>Cochrane Database Syst Rev</i>
Bowen ²⁸	Short-course oral cotrimoxazole versus intramuscular benzathine benzylpenicillin for impetigo in a highly endemic region: an open-label, randomized, controlled, noninferiority trial	<i>Lancet</i>
Jo ²²	Over-the-head two-thumb encircling technique as an alternative to the two-finger technique in the in-hospital infant cardiac arrest setting: a randomized crossover simulation study	<i>Emerg Med J</i>
Thielecke ³¹	Treatment of Tungiasis with dimeticone: a proof-of-principle study in rural Kenya	<i>PLoS Negl Trop Dis</i>
Andrews ²⁷	Simplified severe sepsis protocol: a randomized controlled trial of modified early goal-directed therapy in Zambia	<i>Crit Care Med</i>
Means ¹⁸	Correlates of inappropriate prescribing of antibiotics to patients with malaria in Uganda	<i>PLoS One</i>
Cavalcanti ²⁰	Evaluation of the WHO classification of dengue disease severity during an epidemic in 2011 in the state of Ceara, Brazil	<i>Mem Inst Oswaldo Cruz</i>
Kerr ³⁰	An inexpensive device to treat postpartum hemorrhage: a preliminary proof-of-concept study of health provider opinion and training in Nepal	<i>BMC Pregnancy Childbirth</i>
WHO ³³ Gehani ¹⁷	Antimicrobial resistance: global report on surveillance Association of risk factors with myocardial infarction in Middle Eastern countries: the INTERHEART Middle East study	<i>Eur J Prev Cardiol</i>
Disaster and humanitarian response		
Wuthisuthimethawee ²⁴ Hayman ¹⁵	Wound management in disaster settings Burden of cardiovascular morbidity and mortality following humanitarian emergencies: a systematic literature review	<i>World J Surg</i> <i>Prehosp Disaster Med</i>
WHO ³² Cooper ²⁹	A systematic review of public health emergency operations centers Pediatrics in disasters: evaluation of a global training program	<i>Adv Pediatr</i>
EM development		
Seidenberg ³⁴ Evans ²¹	Epidemiology of injuries, outcomes, and hospital resource utilization at a tertiary teaching hospital in Lusaka, Zambia Attention to local health burden and the global disparity of health research	<i>Afr J Emerg Med</i> <i>PLoS One</i>

GEMLR = Global Emergency Medicine Literature Review.

with pneumonia and malnutrition in Bangladesh. Almost 9% died within 3 months of mostly respiratory or diarrheal illnesses, and poor nutritional status at admission or discharge as well as poor follow-up were associated with mortality.

Untreated impetigo can lead to serious complications, such as poststreptococcal glomerulonephritis, bacterial sepsis, and osteomyelitis. Bowen et al.²⁸ performed an open-label, randomized controlled study that demonstrated the noninferiority of oral cotrimoxazole compared to intramuscular benzathine benzylpenicillin.

Tungiasis is a neglected widespread parasitic disease that is usually self-limited, but can cause severe

pain and inflammation, disfigurement of feet, and serious secondary infections from nonsterile removal attempts. Definitive treatment is surgical removal. Standard nonsurgical treatment with potassium permanganate plus petroleum jelly is thought to be minimally effective. Thielecke et al.³¹ report a proof-of-principle study that examines a possible role of topical dimeticone therapy for the treatment of tungiasis.

Duong et al.³⁵ evaluated the performance of the Determine HIV-1/2 Ag/Ab combo fourth-generation rapid test for detecting acute HIV infections in a cross-sectional household survey in Swaziland. In over 18,000

patients, the test was not able to detect acute infections with high sensitivity.

As in last year's review, the new 2009 WHO dengue classification was studied by different researchers. Carrasco et al.²⁶ created a predictive tool based on laboratory data, pertinent history, and clinical symptoms that identifies those most likely to develop severe dengue according to the new 2009 WHO dengue classification criteria.

Cavalcanti et al.²⁰ found that in a retrospective cross-sectional study using data from a large 2011 dengue outbreak in Brazil, the 2009 WHO classification criteria were more accurate in predicting severe disease than the 1997 version.

Finally, the WHO published the first global survey of antimicrobial resistance as a gray literature article.³³ It describes an increasingly concerning reality and establishes a standard by which future resistance patterns can be monitored.

Three Studies Examined Peripartum Complications and Newborn Screening. Postpartum hemorrhage is the leading cause of maternal mortality worldwide and a concern for public health practitioners and acute care providers alike, particularly in areas where definitive obstetric care may be delayed or unavailable. Kerr et al.³⁰ report on a proof-of-concept study evaluating a novel, inexpensive, pneumatic antishock garment made of bicycle tire tubes and locally available cloth for the treatment of postpartum hemorrhage.

Zhao et al.¹⁴ demonstrated in a prospective multicenter screening study involving over 130,000 consecutive deliveries in 18 hospitals in China that the routine use of pulse oximetry in addition to clinical assessment was feasible and accurate in detecting not only life-threatening congenital heart disease, but also serious congenital heart disease.

Saccone and Berghella¹⁶ performed a meta-analysis of five randomized controlled clinical trials studying antibiotic prophylaxis versus placebo for singleton gestations with premature rupture of membranes in Mexico, Spain, Chile, Portugal, and Egypt. Prophylactic antibiotics did not reduce the rate of chorioamnionitis or neonatal sepsis, except in cases where latency was longer than 12 hours.

Injury Is Exceeding Communicable Illnesses as a Leading Cause of Death in Many Countries.⁴⁰ A systematic review by Gupta et al.³⁷ assessed the capacity of health care facilities in low- and middle-income countries to deliver burn care. It highlights the dire need for increased capacity for burn management, particularly in light of the burden of morbidity and mortality.

Emergency Medicine Development

This year, 16% of the articles selected for full review were from the EM development category, with a focus on health disparities and trauma. Wide global health disparities between high-income and low- and middle-income countries remain and are well known. Using NLM Medical Subject Headings corresponding to 111 disease categories from the WHO Global Burden of

Disease (GBD) Project, Evans et al.²¹ identified about 3,770,000 distinct disease-related articles from 2 years (2002, 2004) for which corresponding country-specific GBD data were also uniformly available. They found a significant global mismatch between disease research and illness burden, fueled by national differences in research productivity and local disease burden. The few wealthy nations that dominate health research focus on locally important conditions, leaving other diseases with large global burdens scientifically underrepresented due to weaker research capacity in the low-income settings where these diseases predominate.

Seidenberg et al.³⁴ report on a prospective observational study conducted at an urban teaching hospital in Lusaka, Zambia. Nearly 3,500 patients were enrolled in a registry designed to evaluate the epidemiology and injuries of patients presenting due to trauma. Fewer than 25% arrived within the first hour of their injuries, and the most common mechanisms of injury included falls, road traffic accidents, and assault. Of the patients admitted, more than half required surgical intervention. The study demonstrated that the development of a trauma registry was feasible and useful in an urban setting in sub-Saharan Africa.

Disaster and Humanitarian Response

In 2014, articles from DHR comprised 8% of the fully reviewed articles. The initial management of a patient and his or her wounds in a disaster setting is known to be a critical time for patient long-term outcome, morbidity, and mortality. A systematic review by Wuthisuthimethawee et al.²⁴ develops guidelines for first responders and nonexpert health care providers on wound management in disaster settings.

Disasters disproportionately affect children, and emergency providers in resource-limited environments need critical knowledge and skills to improve their care in disasters. Cooper et al.²⁹ describe an educational intervention aimed at improving care of children in disaster, which may serve as a model for high-impact short-course development, implementation, and assessment across many low- and middle-income countries.

Hayman et al.¹⁵ performed a systematic review to evaluate the interaction between the increasing frequency of large-scale humanitarian emergencies and global burden of cardiovascular mortality. The study concluded that conflicts are associated with an increase in long-term morbidity from acute coronary syndrome.

The WHO performed a well-designed systematic review on emergency operations centers (EOC) to describe and benchmark best practices, with the goal of strengthening capacity to effectively respond to public health emergencies.³² Nine EOC qualities were identified as important for effective emergency response: collaboration, coordination, communication, cooperation, harmonization, integration with vertical and horizontal programing, leadership, respect, and trust. The authors highlight legal and ethical issues surrounding EOCs as a priority for future research and call for international standards and guidelines on EOC operations, data collection, information management, risk communication, and training. This represents the second gray literature article included in this year's review.

CONCLUSIONS

Global emergency medicine is a field that is quickly growing in both depth and breadth. As the specialty expands, the body of literature it produces continues to increase and diversify. These articles represent examples of the high-quality and high-impact emergency medicine research currently being conducted around the world. We hope that these articles will foster further growth in the field, promote evidence-based practice, and encourage global discourse and further research.

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- Torben K. Becker, MD, PhD, Department of Emergency Medicine, University of Michigan, Ann Arbor, MI
- Mark Bisanzo, MD, DTM&H, Department of Emergency Medicine, University of Massachusetts, Worcester, MA
- Aislinn Black, DO, Department of Emergency Medicine, MedStar Franklin Square Medical Center, Baltimore, MD
- Michael Boyd, MD, Department of Emergency Medicine, University of Michigan, Ann Arbor, MI
- Jennifer Chan, MD, MPH, Department of Emergency Medicine, Northwestern Memorial Hospital, Chicago, IL, and Harvard Humanitarian Initiative, Cambridge, MA
- Karen Ekernas, MD, MPH, Department of Emergency Medicine, Hennepin County Medical Center, Minneapolis, MN
- Emily Grover, MD, Fellow in Medical Simulation and Education, Brigham & Women's Hospital, Boston, MA
- Bhakti Hansoti, MBChB, MPH, Department of Emergency Medicine, Johns Hopkins University, Baltimore, MD
- Alison S. Hayward, MD, MPH, Yale School of Medicine, New Haven, CT
- Braden Hexom, MD, Department of Emergency Medicine, Icahn School of Medicine at Mount Sinai, New York, NY
- Gabrielle A. Jacquet, MD, MPH, Department of Emergency Medicine, Boston University School of Medicine, and Boston University Center for Global Health and Development, Boston, MA
- Alexander Jenson, MD, MPH, Department of Emergency Medicine, Johns Hopkins University, Baltimore, MD
- Alexis Kearney, MD, MPH, Department of Emergency Medicine, Rhode Island Hospital, Providence, RI
- Andrew Kestler, MD, MBA, DTMH, FRCPC, Department of Emergency Medicine, University of British Columbia, and St. Paul's Hospital, Vancouver, BC, Canada
- Maxwell Osei-Ampofo, MBChB, MBA, MGCS (EM), MPH, Accident & Emergency Department, Komfo Anokye Teaching Hospital, and Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
- Stephanie Kayden, MD, MPH, Department of Emergency Medicine, Brigham and Women's Hospital, Boston, MA, and Harvard Humanitarian Initiative, Cambridge, MA
- Christopher Lam, Warren Alpert Medical School of Brown University, Providence, RI
- Adam C. Levine, MD, MPH, Department of Emergency Medicine, Warren Alpert Medical School of Brown University, Providence, RI
- Xiaoguang Li, MD, Shanghai United Family Hospital, Shanghai, China
- Kevin Lunney, MD, PhD, Medical Corps, US Navy, Department of Emergency Medicine, Navy Hospital Camp Lejeune, Camp Lejeune, NC
- Jacqueline Mahal, MD, MBA, Department of Emergency Medicine, National University Hospital, Singapore
- Regan H. Marsh, MD, MPH, Department of Emergency Medicine, Brigham and Women's Hospital, Boston, MA, and Partners In Health, Boston, MA

APPENDIX A

Global Emergency Medicine Literature Review (GEMLR) Group (alphabetical):

R. Eleanor Anderson, MD, Department of Emergency Medicine, Brigham and Women's Hospital, Boston, MA

Miriam Aschkenasy, MD, MPH, Center for Global Health at Massachusetts General Hospital, Boston, MA, and Harvard Humanitarian Initiative, Cambridge, MA

Kamna S. Balhara, MD, MA, Department of Emergency Medicine, Johns Hopkins University, Baltimore, MD

Susan Bartels, MD, MPH, Department of Emergency Medicine, Queen's University, Kingston, Canada, and Harvard Humanitarian Initiative, Cambridge, MA

Daniel J. Millikan, MD, Department of Emergency Medicine, Providence Regional Medical Center, Everett, WA

Payal Modi, MD, MSc, Department of Emergency Medicine, Brigham and Women's Hospital, Boston, MA, and Harvard Humanitarian Initiative, Cambridge, MA

Tu Carol Nguyen, DO, Department of Emergency Medicine, University of Maryland Medical Center, Baltimore, MD

Usha Periyayagam, MD, MPH, MS, Instructor of Emergency Medicine, Harvard Medical School, Brigham and Women's Hospital, Boston, MA

Najeeb Rahman, MBChB, DHA, DPH, Emergency Department, Tawam Hospital, Al Ain, UAE

Erika D. Schroeder, MD, MPH, Department of Emergency Medicine, Providence Regional Medical Center, Everett, WA

Anand Selvam, MD, Department of Emergency Medicine, University of Cincinnati Medical Center, Cincinnati, OH

David Silvestri, MD, MBA, Department of Emergency Medicine, Brigham and Women's Hospital, and Department of Emergency Medicine, Massachusetts General Hospital Boston, MA

Sabrina Titze, MD, PhD, Department of Internal Medicine and Cardiology, Oberhavel Kliniken, Hennigsdorf, Germany

Indi Trehan, MD, MPH, DTM&H, Department of Pediatrics, Washington University, St. Louis, MO; Department of Pediatrics and Child Health, University of Malawi, Blantyre, Malawi; Institute for Public Health, Washington University in St. Louis, St. Louis, MO

Tyson B. Welzel, MBChB, EMDM, MMed Sc(Clin Epi), Division of Emergency Medicine, University of Cape Town, Cape Town, South Africa