

# ORIGINAL RESEARCH

## Developing-World Disaster Research: Present Evidence and Future Priorities

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### ABSTRACT

**Objectives:** The technology and resource-rich solutions of the developed world may not be completely applicable to or replicable in disasters occurring in the developing world. With the current looming hazards of pandemics, climate change, global terrorism and conflicts around the world, policy makers and governments will need high-quality scientific data to make informed decisions for preparedness and mitigation. The evidence on disasters in peer-reviewed journals about the developing world was examined for quality and quantity in this systematic review.

**Methods:** PubMed was searched using the Medical Subject Heading (MeSH) terms *disasters*, *disaster medicine*, *rescue work*, *relief work*, and *conflict* and then refined using the MeSH term *developing country*. The final list of selected manuscripts were analyzed by type of article, level of evidence, theme of the manuscript and topic, author affiliation, and region of the study.

**Results:** After searching and refining, <1% of the citations in PubMed addressed disasters in developing countries. The majority was original research articles or reviews, and most of the original research articles were level IV or V evidence. Less than 25% of the authors were from the developing world. The predominant themes were missions, health care provision, and humanitarian aid during the acute phase of disasters in the developing world.

**Conclusions:** Considering that 85% of disasters and 95% of disaster-related deaths occur in the developing world, the overwhelming number of casualties has contributed insignificantly to the world's peer-reviewed literature. Less than 1% of all disaster-related publications are about disasters in the developing world. This may be a publication bias, or it may be a genuine lack of submissions dealing with these disasters. Authors in this part of the world need to contribute to future disaster research through better-quality systematic research and better funding priorities. Aid for sustaining long-term disaster research may be a more useful investment in mitigating future disasters than short-term humanitarian aid missions to the developing world.

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**Key Words:** disasters, disaster medicine, rescue work, relief work, conflict, developing country

It is commonly understood that there is an inverse relation between the wealth of a nation and disaster risk.<sup>1</sup> Richer nations are better able than poorer nations to protect themselves and mitigate the effects of disasters. They experience fewer deaths and damage, although the number of catastrophic events in wealthy countries is about the same as in poorer countries.<sup>2</sup> The technology and resource-rich solutions available to the developed world may not be completely applicable to or replicable in the developing world. Poorer countries suffer disproportionately more because disasters overwhelm local health resources and response more easily and further damage the economies of poor nations.<sup>3</sup> Not all nations are affected equally and after a major disaster, some of the better-off developing-world economies may improve themselves economically by reinventing themselves.<sup>4</sup>

The body of research available on the subject of disaster medicine is growing. Considering, however, that 85% of disasters<sup>5</sup> and 95% of disaster-related deaths<sup>6</sup> occur in the developing world, the overwhelming number of casualties has contributed insignificantly to the world's

peer-reviewed literature.<sup>2</sup> This evidence, or the lack of it, is of concern because it forms the basis of practice and advocacy for addressing future disasters. With the looming hazards of pandemics, climate change, global terrorism, and armed conflicts, policy makers and governments will need high-quality scientific data to make informed decisions for preparedness and mitigation.<sup>7</sup> We examined the available evidence on disasters in the developing world in peer-reviewed journals for quality and quantity in this systematic review.

### METHODS

Using the available literature about disasters in the developing world in medical and public health journals, we searched PubMed using the Medical Subject Heading (MeSH) search terms *disasters*, *disaster medicine*, *rescue work*, *relief work*, and *conflict*. There were no limits set for the time period or the type of articles. All foreign-language articles were included. The search was refined using the MeSH terms *developing country*, including *developing nation*, *under-developed countries*, *under-developed nation*, *Third-World countries*, *less-developed countries*, and *less-developed nations*. *Developing nation* was

TABLE 1

Publication Type With Level of Evidence						
Type	Level II	Level III	Level IV	Level V	Total	%
Article	0	4	62	87	153	36.1
Review			12	31	44	10.4
Comment			14	109	125	29.5
Case reports			4	8	12	2.8
Editorial				18	18	4.2
Interview				4	4	0.9
Letter				35	35	8.3
News				24	24	5.7
Report				9	9	2.1
Total	0	4	92	325	424	100

TABLE 2

Author From Developed or Developing Country					
Level of Evidence	Developed	%	Developing	%	Total
III	0	0.0	4	100.0	4
IV	57	62.0	35	38.0	92
V	265	86.0	43	14.0	308
Total	322	79.7	82	20.3	404

defined using the International Monetary Fund criteria of emerging and developing economies in the analysis.<sup>8</sup> Duplicate articles were removed. The final list of selected manuscripts was analyzed by type of article, level of evidence, theme of the manuscript and topic, author affiliation, and region of the study. All of the articles were classified according to the type of publication as original article, review article, case report, comment, editorial, interview, letter to the editor, news article, or report. They were further classified into various levels of evidence using a standardized classification of levels of evidence, formulated by the Centre for Evidence Based Medicine.<sup>9</sup> Briefly, the levels are level I: randomized controlled trials, prospective cohort studies; level II: retrospective cohort studies, outcomes research; level III: case-control studies; level IV: case-series studies; level V: case reports, expert opinion, or comment.

Two of the authors (P.T. and N.R.) reviewed and coded all of the records independently. All of the coding discrepancies were discussed and reconciled through consensus. Authors of articles with no clear affiliations were subjected to a broad Internet search using Google. Author affiliations that were unavailable after this process were classified as “missing information,” and 20 articles were excluded from the author analysis. The origin of collaborative studies between developing- and developed-world authors was classified using the country of the first author’s institute or organization. Each of these articles was also classified by the topic or theme of the manuscript. Fourteen articles were excluded because they did not belong to the domains of disasters, conflicts, or disaster medi-

cine, even though they were selected by PubMed. Level III articles were evaluated in detail for methodology.

## RESULTS

Citations using the MeSH search terms *disasters*, *disaster medicine*, *rescue work*, *relief work*, and *conflict* yielded 63 196 results. After these results were refined using the MeSH term *developing country*, 438 articles were retained. Less than 1% (0.69%) of the citations in the disaster-related literature on PubMed addressed developing-country disasters.

Publication type and level of evidence were analyzed, and about half of these manuscripts (46.5%) were found to be original research articles (36.1%) or reviews (10.4%), and more than one-fourth (29.5%) were commentaries. Case reports, editorials, interviews, letters to editors, news articles, or reports made up the balance of all of the publications. A total of 97.4% (149/153) of all of the original research articles were level IV or V evidence. All of the reviews were either level IV or V evidence. No publication was categorized as level I or II evidence. These findings were tabulated (Table 1). The percentage of agreement between the 2 authors, while classifying each of the articles for the level of evidence using the Centre for Evidence Based Medicine criteria, was 93.8%.

One-fifth (20.3%) of the authors of all of the articles on disasters in the developing world were from the developing world (82/404), the rest being from the developed world (Table 2). Three publications (3/404) with level III evidence were writ-

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ten by developing-world authors and 1 was by developed-world authors. Author affiliations of 20 of 404 manuscripts could not be determined and were labeled as missing (4.9%). A total of 2.7% (11/404) of the articles were collaborative studies.

The predominant theme (29.1%) was missions, health care provision, and humanitarian aid during the acute phase of disasters in the developing world. Commentaries on policies, vulnerable populations, and food, water, and nutrition were the next most common topics. Tools, mental health, specific diseases, armed conflicts, ethics, and epidemiology were addressed by a smaller proportion of articles. The breakdown of topics and themes is found in Table 3. The 4 evidence level III articles were evaluated and tabulated in Table 4.

### COMMENT

#### Number of Citations

The paucity of articles written about developing-world disasters is evident. The reasons for the publishing silence may be multifactorial.<sup>14</sup> Poor funding for research, competing clinical commitments, pressure in developing-world hospitals to pro-

vide services rather than publish research, poor methodology leading to rejection by peer-reviewed journals, and the lack of ability in English are possible barriers, which may explain this disparity. There may be a publication bias in medical journals against diseases that ravage the least-developed regions of the world.<sup>15</sup> Our dismal finding that <1% of articles focused on developing world disasters was in stark contrast to the fact that 85% of disasters do occur in the developing world.<sup>5</sup>

### Levels of Evidence

Besides the number of publications, the other cause for concern is the lower level of evidence that dominates the existing disaster medicine literature. The subgroup of developing-world research publications must be elevated first to be on par with the disaster publications from the developed world. Unfortunately, level IV and V publications, which dominate developing-world disaster publications, add little to the evidence base. There is a body of literature, however, that provides the knowledge base for relief during disasters in the developing world. These are internal documents published by international relief agencies such as the World Health Organization, the United Nations, the Red Cross, Doctors Without Borders, and Oxfam, which are usually available in the public domain with free full-text access. Although these documents constitute expert opinion reports (level V evidence), which have not been subject to the rigor of the peer-review process, these documents are sometimes used as best practices guidelines by most disaster relief workers.

Generating level I data (randomized controlled trials) is unlikely in the disaster setting, given the nature of the event and interventions; therefore, the strategy would be to generate more level II and III publications. Cohort studies, audit, or outcomes research, which would qualify as level IIb/IIc or Level IIIa/IIIb, require follow-up studies of the victims for an extended period of time. Long-term studies, with more robust methodology, are what are sometimes needed to improve the scientific base of studies in disasters. To aid in this objective, the developed world could aid researchers from developing nations by building capacity for good research methodology and commissioning level II or

TABLE 3

Topics of Developing-World Disaster Publications		
Theme/Topic	n	%
Mission	62	15.4
Policy	59	14.6
Women, children, vulnerable population	53	13.2
Food, water, nutrition	47	11.7
Environment	32	7.9
Health care provision	29	7.2
Humanitarian aid	26	6.5
Global diseases	22	5.5
Mental health	17	4.2
Tool	15	3.7
Natural	13	3.2
Specific diseases	12	3.0
Conflict	19	4.7
Ethics	8	2.0
Epidemiology	7	1.7
Manmade	3	0.7

TABLE 4

Summary of Level II and Level III Publications				
Author	Vijayakumar et al <sup>10</sup>	Choudhury and Bhuiya <sup>11</sup>	Ahmad <sup>12</sup>	Sorensen et al <sup>13</sup>
Type of study	Postdisaster intervention, case-control study	Pre- and postdisaster	Epidemiology	Case observation study
Disaster	Tsunami	Floods	Vulnerability	Vulnerability
Setting	Developing country	Developing country	Developing country	Developing country
Author affiliation	Developing country	Developing country	Developing country	Developed country
Target population	Children	Children	Infants	Women
Intervention	Psychosocial	Nutrition education program	Infant mortality trends	Monitoring obstetric care and confidential inquiry
Result	Children are resilient; concerns about preexisting vulnerability	Malnourishment after floods	Multifactorial: health, public and agricultural	Quality assurance and maternal death audit

III studies. Some of the examples of better developing-world research are seen in Table 4, in which the authors have used epidemiological methods for evaluating trends, validated testing tools, case-control or case-audit methodology to research developing-world problems. Finally, learning from developed-world research, the direction for the future should be systematic surveys with primary data collection, appropriate sampling methods, prospective cohort studies with >80% follow-up rates, and analysis based on clinically sensible costs or alternatives.<sup>9</sup> These would constitute high-quality (level Ib/Ic) studies.

### Authors

The underrepresentation of the developing world in peer-reviewed disaster literature may be a reflection of the publishing world in general. In a retrospective survey of articles published in the *British Medical Journal*, *The Lancet*, *the New England Journal of Medicine*, *Annals of Internal Medicine*, and the *Journal of the American Medical Association*, Sumathipala and co-workers found that 6.5% of the publications in these journals are written by authors from countries in which 90% of the world's population live.<sup>14</sup> In our study, four-fifths of the authors were from the developed world writing about the developing world. Therefore, it was not unusual that many publications focused on the acute phases of response and short-term recovery. These phases of disasters are convenient for visiting rescue teams to write about. The short temporal relation of health care personnel and disaster victims is reflected in the cross-sectional nature of the publications. This developed-world view of developing-world disasters represents the predominant view in the indexed PubMed literature. In our study, only 2.7% (11/404) articles were collaborative studies. This is not uncommon in other medical research works, in which there are a significant number of articles using developing-world data without a single author from these countries.<sup>14</sup> However, collaborative studies that build capacity in countries with low-science intensity by developed-world scientists with greater experience in disaster research may provide the push needed for high-quality evidence in disaster medicine.<sup>16</sup>

### Topics and Themes

The most common topics (28.2%) were missions, health care provision, and humanitarian aid during developing-world disasters. Commentaries about policies, vulnerable populations, and food, water, and nutrition were the next most commonly found in citations. These commentaries and letters to the editor usually lamented the poor working conditions and lack of interagency coordination in the developing-world disaster zones. Furthermore, there was a strong reporting bias about the good work done by missions and field hospitals for developing-world victims, although there is evidence of their limitations.<sup>17-19</sup>

There are definite gaps in the themes covered by these publications. Tools, mental health, specific diseases, conflicts, ethics, and epidemiology were addressed in a small proportion of articles. Mental health, in particular, lends itself to systematic research, using premeasures and comparison groups between ex-

posed and the unexposed people.<sup>20</sup> The future priority areas in research include long-term economic outcomes, health system recovery, occupational rehabilitation of victims, community-based disaster preparedness, resilience of communities in low-resource settings, public health interventions, monitoring and evaluation of interventions, and research tools validated for the developing world. Alongside these, the developing world needs to be concerned about the ethical issues involved in research on vulnerable populations.<sup>21,22</sup> Not all nations are affected equally and some of the more well-off developing-world economies will emerge economically more robust after a major disaster by re-inventing its economic strategy.<sup>4</sup> These existing social and economic risk differences between the nations, within the group of emerging and developing economies, is another unexplored area in the current disaster-related literature.

### Developing World Research Priorities

Proposed solutions for the developing world are missing in the literature. These solutions are primarily opinions or exploratory studies. To develop indigenous research, a more systematic approach and a local research agenda for developing-world nations will be required, rather than transplanting developed-world tools and interventions. The focus of the knowledge base will need to shift away from the acute phase of disasters and to prevention, mitigation, and preparedness. Long-term recovery studies will be the immediate next priority, along with standardizing definitions and research methodology for future studies. Finally, funding will determine the pace of research. Humanitarian aid is directed at the acute phase of disasters and millions of dollars have been spent on humanitarian missions. It would be cost-effective to channel some of these funds toward developing-world research, as sustained aid to promote research in disaster medicine. These investments in developing-world preparedness planning, would pay dividends in mitigating future disasters.

Although there may be lessons learned from disasters in the developing world, these are not visible in the disaster-related literature. This may be a publication bias or a genuine lack of submissions addressing developing-world disasters. Research drives advocacy and that in turn drives policy; however, the developing world does not yet contribute to it.

### Limitations

The limitation of this study is that it uses only PubMed. Because PubMed is the only free database available to researchers in the developing world, it was selected for the searches. Although the searches use the robust MeSH classification system developed by the National Library of Medicine, the exact proportion of misclassification errors in PubMed is not known. Furthermore, disaster medicine is an emerging science and was only recognized as a MeSH term by the National Library of Medicine in 2008. There are differences that need to be acknowledged within the capacities of developing nations, although they have been pooled together as emerging economies. China and India are notable examples, as are a few countries in Africa, such

as South Africa.<sup>7</sup> Lastly, all of the authors of the present study are from the developing world, which may have contributed to some of the classification bias about the levels of evidence and author affiliations of the articles.

## CONCLUSIONS

Most disasters and deaths from disasters occur in the developing world; however, <1% of all disaster-related articles are about disasters in the developing world. The developed world authors four-fifths of the articles about developing-world disasters and contributes the predominant perspective. It is important that the developing world contributes to our learning about disasters through better-quality systematic research. Aid for sustaining long-term disaster research may be a more useful investment in mitigating future disasters than short-term humanitarian aid missions to the developing world.

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## REFERENCES

1. Kellenberg D, Mobarak A. Does rising income increase or decrease damage risk from natural disasters? *J Urban Econ*. 2008;63:788-802.
2. Kahn ME. The death toll from natural disasters: the role of income, geography, and institutions. *Rev Econ Stat*. 2005;87:271-284.
3. Toya H, Skidmore M. Economic development and the impacts of natural disasters. *Econ Lett*. 2007;94:20-25.
4. Crespo Cuaresma J, Hlouskova J, Obersteiner M. Natural disasters as creative destruction? Evidence from developing countries. *Econ Inq*. 2008;46:214-226.
5. Quarantelli E. Research findings on organizational behavior in disasters and their applicability in developing countries. *PRELIMINARY PAPER #107*. Disaster Research Center. Retrieved from <http://dspace.udel.edu.8080/dspace/handle/19716/481?mode=simple>. Accessed May 14, 2011.
6. Alcántara-Ayala I. Geomorphology, natural hazards, vulnerability and prevention of natural disasters in developing countries. *Geomorphology*. 2002;47:107-124.
7. King DA. The scientific impact of nations. *Nature*. 2004;430(6997):311-316.
8. International Monetary Fund. World Economic and Financial Surveys. World Economic Outlook. Database—WEO Groups and Aggregates Information. April 2010. <http://www.imf.org/external/pubs/ft/weo/2010/01/weodata/groups.htm#oem>. Accessed May 6, 2011.
9. Centre for Evidence Based Medicine. Levels of evidence. *J Evid Based Dent Pract*. 2009;9(1):A5-A8.
10. Vijayakumar L, Kannan GK, Ganesh Kumar B, Devarajan P. Do all children need intervention after exposure to tsunami? *Int Rev Psychiatry*. 2006;18(6):515-522.
11. Choudhury AY, Bhuiya A. Effects of biosocial variables on changes in nutritional status of rural Bangladeshi children, pre- and post-monsoon flooding. *J Biosoc Sci*. 1993;25(3):351-357.
12. Ahmad S. Trends and regional differentials in mortality in Bangladesh. *Rural Demogr*. 1988;15(1-2):27-39.
13. Sorensen BL, Elsass P, Nielsen BB, Massawe S, Nyakina J, Rasch V. Substandard emergency obstetric care—a confidential enquiry into maternal deaths at a regional hospital in Tanzania. *Trop Med Int Health*. 2010;15(8):894-900.
14. Sumathipala A, Siribaddana S, Patel V. Under-representation of developing countries in the research literature: ethical issues arising from a survey of five leading medical journals. *BMC Med Ethics*. 2004;5:E5.
15. Horton R. Medical journals: evidence of bias against the diseases of poverty. *Lancet*. 2003;361(9359):712-713.
16. Horton R. North and South: bridging the information gap. *Lancet*. 2000;355(9222):2231-2236.
17. von Schreeb J, Riddez L, Samnegård H, Rosling H. Foreign field hospitals in the recent sudden-onset disasters in Iran, Haiti, Indonesia, and Pakistan. *Prehosp Disaster Med*. 2008;23(2):144-151, discussion 152-153.
18. Roy N, Shah H, Patel V, Coughlin RR. The Gujarat earthquake (2001) experience in a seismically unprepared area: community hospital medical response. *Prehosp Disaster Med*. 2002;17(4):186-195.
19. Roy N. The Asian Tsunami: PAHO disaster guidelines in action in India. *Prehosp Disaster Med*. 2006;21(5):310-315.
20. Stoddard FJ Jr. Methods for Disaster Mental Health Research [book review]. *Psychiatr Serv*. 2008;59:815-816.
21. Chung B, Jones L, Campbell LX, Glover H, Gelberg L, Chen DT. National recommendations for enhancing the conduct of ethical health research with human participants in post-disaster situations. *Ethn Dis*. 2008;18(3):378-383.
22. Perlman D. Public health practice vs research: implications for preparedness and disaster research review by State Health Department IRBs. *Disaster Med Public Health Prep*. 2008;2(3):185-191.