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The Impact of Disasters on Populations With Health and Health Care Disparities

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Abstract

Context—A disaster is indiscriminate in whom it affects. Limited research has shown that the poor and medically underserved, especially in rural areas, bear an inequitable amount of the burden.

Objective—To review the literature on the combined effects of a disaster and living in an area with existing health or health care disparities on a community's health, access to health resources, and quality of life.

Methods—We performed a systematic literature review using the following search terms: disaster, health disparities, health care disparities, medically underserved, and rural. Our inclusion criteria were peer-reviewed, US studies that discussed the delayed or persistent health effects of disasters in medically underserved areas.

Results—There has been extensive research published on disasters, health disparities, health care disparities, and medically underserved populations individually, but not collectively.

Conclusions—The current literature does not capture the strain of health and health care disparities before and after a disaster in medically underserved communities. Future disaster studies and policies should account for differences in health profiles and access to care before and after a disaster.

Keywords

disaster; health disparities; health care disparities; medically underserved; surge capacity

A disaster is indiscriminate in whom it affects, but limited research has shown that poor and medically underserved people, especially people residing in rural areas, bear an unequal amount of the burden.^{1–7} Rural communities nationwide disproportionately suffer from a lack of public health infrastructure.^{8–11} In a disaster, continuity of care is often disrupted, leaving behind the vestige of a fragmented primary and mental health infrastructure.^{2–4,7,12–14} This situation is especially distressing for medically under-served areas struggling with persistent health and/or health care disparities. Disasters themselves can catalyze new or exacerbate existent disparities in health and health care within the affected population. We define *health* and/or *health care disparities* as differences in health and health care availability across diverse

populations.¹⁵ There is limited information on the impact of disasters on access to health care, use of health care services, and the exacerbation of health disparities in medically underserved areas.

Medical resource–poor communities can be labeled as medically underserved areas. Medically underserved areas are currently indexed by the US Department of Health and Human Services Health Resources and Services Administration based on inherent disparities in the following: (1) health care provider to population ratio, (2) infant mortality rate, (3) the percentage of population living at less than 100% of the federal poverty line, and (4) the percentage of the population aged 65 years or older.^{16,17} For this article, we use medically underserved areas as an indicator for health care disparities. Medically underserved areas are low-income areas that demonstrate insufficient primary medical care coverage and are often located in rural communities.^{3,16,18–23}

In 2007, roughly 20% of Americans experienced delayed access or were unable to obtain access to medical care²⁴; since then, access for insured and uninsured people has declined. Persistent unmet needs and delayed care contribute to underlying health disparities in communities, especially among vulnerable populations. Disparities in need and deferred care pose serious threats to health for disaster victims.

Rural areas are likely to carry an inequitable amount of the burden of health care disparities and are home to a unique set of health care disparities. These disparities contribute to the inadequate provision of basic health care services that arise from fewer medical facilities, a minimal number of providers, fewer specialty practices, and a lack of accompanying technical innovations.^{19–21,25–27} In rural medically underserved settings, people experiencing barriers to primary health care tend to be low income, people of color, underinsured or uninsured, less educated, and unemployed.^{24,28–35} Nearly a quarter of the US population lives in rural areas, and more than 20% of rural residents are living at or below the US poverty line.^{28,33} Rural communities are faced with a myriad of health care disparities, each posing as a barrier to timely response and complete recovery from a disaster, including insufficient public health infrastructure.^{7,9,28,36} Reports show that rural areas experience disproportionate access to adequate medical care. These reports have informed an emerging literature revealing that health care disparities have been a persistent understudied and underaddressed issue.^{1,15,37,38}

DISASTERS

There are 2 main types of disasters: natural and technological. Natural disasters occur outside the control of humans, whereas technological disasters are breakdowns in human-made systems.^{5,39,40} Immediate threats to public health during the response to a disaster are quite evident. When disaster strikes, the health care system is immediately overwhelmed with injuries and acute illness needs during the initial surge, defined as the sudden increase in demand for emergency medical services. Often, acute illnesses occurring in the initial *surge* evolve into chronic health needs during the recovery phase of a disaster.⁴ For example, studies have documented long-term medical needs of victims of the World Trade Center collapse due to their extremely high caustic dust exposure,^{41–56} of victims of forest fires who had smoke inhalation,^{57,58} and of survivors of the 2004 tsunami who aspirated large quantities of seawater.^{59–61}

Disasters pose greater threats to communities lacking resources and access to health care,^{3,4,11,14,36,40,62} which are precursors to health care disparities. However, health care disparities are not usually explicitly accounted for in surge capacity modeling.⁶³ A recent report, “Altered Standards of Care in Mass Casualty Events: Bioterrorism and Other Public Health Emergencies” published by the Agency for Healthcare Research and Quality⁶⁴ recommended that strategic steps be taken to address community-level factors in response planning, but made

no mention of persistent health or healthcare disparities often inherent in these communities.
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Health and health care disparities are seldom addressed in disaster response and recovery planning. While disaster epidemiology has been recognized as an emerging field with the expansion of human populations into disaster-susceptible regions and global climate change looming on the horizon,^{6,65–69} the impact of health and health care disparities on disaster epidemiology has not.

There is a paucity of information on the combined effects of a disaster and living in a rural area or other area with existing health or health care disparities on a community's health, access to health resources, and quality of life during the disaster recovery phase. To our knowledge, there has been no report of the burden of extant and incident chronic disease during the disaster recovery phase for a vulnerable community plagued with health disparities in the aftermath of a disaster. Yet, we know that these disparities exist in populations affected by disaster.^{2,3,12,14} Alternatively, this gap conflicts with the extensive collection of articles published in the lay press during the last 30 years consistently documenting the unmet needs of under-served populations affected by a disaster. The purpose of this article is to document the current status of the science regarding the impact of disaster on health and health care disparities. To accomplish this, we conducted a systematic literature review.

METHODS

We selected the following search terms for our systematic literature review: disaster, health disparities, health care disparities, medically underserved, and rural. By using the combination of these search terms, we performed individual inquiries on widely accepted public health electronic search indices, including the Cambridge Scientific Abstracts, CINAHL Plus, MEDLINE (EBSCO), PubMed-MEDLINE, Web of Science (ISI Citation), Annual Reviews, Applied Social Sciences Index and Abstracts, The Cochrane Library, Health Reference Center-Academic, and Ovid Medline for all relevant articles published in the United States from January 1, 1970, to May 15, 2009.

There is considerable uncertainty in the literature regarding exact definitions for health and health care disparities.^{15,70,71} The Health Resources and Services Administration's Index of Medical Underservice has provided a quantifiable way to identify a given area, facility, or population as medically under-served.^{16,17} Therefore, we used medical underservice as a proxy for health and health care disparities because we believe that underservice is the leading culprit behind health and health care disparities and better contextualizes the current problem.

Therefore, we limited our search to studies conducted in the United States. Our initial inclusion criteria were peer-reviewed, US epidemiological studies published in English that discussed the delayed or persistent effects of health and health care disparities in the midst of a disaster for medically under-served areas. Consequently, owing to the absence of epidemiological studies, we expanded our search to all relevant health studies, including the social sciences and health services research.

To further document the disconnect between health and health care disparities and disaster-related health research, we conducted a minisearch of the lay press using the Lexis-Nexis Academic search database. We used the power search option, narrowing the search within news wire services published from January 1, 1970, to May 15, 2009. Search term categories were as follows: health care and disasters; health care, disasters, and recovery; health care, disasters, and chronic diseases; health care, disasters, and long-term effects; health care, disasters, and rural; health disparities and disasters; and disasters and medically underserved.

RESULTS

There has been extensive research published on disasters, health disparities, health care disparities, and medically underserved populations individually, but few studies addressed these topics collectively (Table 1). We reviewed 12 articles that met the inclusion criteria; however, only 7 pertained to disasters in medically underserved populations (Table 2).^{2-4,9,12,14,72} Of those 7, 5 concerned a natural disaster (ie, Hurricane Katrina),^{2-4,12,14} 1 a bioterrorism disaster,⁹ and 1 concerned natural and technological disasters.⁷² There were 3 articles reporting studies of medically underserved populations,^{2,3,72} and only 1 study explicitly targeted rural medically underserved communities.⁹ Of the studies, 4 were cross-sectional,^{2,9,12,14} and the remaining 3 were descriptive.^{3,4,72} There were no relevant follow-up articles addressing the effects of a disaster on a community with preexisting medical underservice issues or subsequent amplified health care disparities after the disaster. The following is a brief critique of each of the 4 cross-sectional studies.

Ford et al¹² conducted a cross-sectional study that explored how an existent surveillance system could be used to estimate chronic disease needs for a natural disaster by using the 2004 Behavioral Risk Factor Surveillance System to estimate prevalence of diabetes, heart disease, stroke, hypertension, and asthma. Car-diopulmonary disease was not included. A quarter of respondents had at least 1 chronic disease, 15.6% had 1 condition, 8.4% had 2 conditions, 1.1% had 3 conditions, and 0.3% had 4 or more conditions. This study revealed that preexisting surveillance systems, such as the Behavioral Risk Factor Surveillance System, can aid disaster response personnel in assessing chronic disease needs among disaster-affected populations. Ford et al¹² demonstrated that chronic disease management after a disaster is an understudied research priority.

Hsu et al⁹ conducted a cross-sectional study that assessed language, confidence, and training needs in responding to public health emergencies among rural medical providers in Texas. The sampling frame consisted of a physician database supplied by the Texas State Board of Medical Examiners. A semistructured survey was mailed or administered over the Internet to 841 practicing or retired physicians in 37 north Texas counties that assessed language use, perceived confidence in ability to respond to public health emergencies, and training experience. Prior experience in chemical exposure emergencies was reported by 20.9% of respondents. Nearly half were willing to offer their services in a public health emergency. However, 77.5% lacked confidence in their skills to effectively diagnose and treat victims of a public health emergency. This study highlighted the fact that many physicians lack public health emergency awareness, knowledge, and expertise, especially physicians in rural areas.

Krol et al² used an innovative mobile medic approach to conduct a cross-sectional survey that identified the acute and chronic health care needs of medically underserved populations residing in Mississippi after Hurricane Katrina. Data from 2 Children's Health Fund mobile medical units at 23 sites in the Gulfport-Biloxi area included all patient encounters (ie, chief complaint, diagnoses, vaccines dispensed, prescription medications distributed, and referrals) from September 5 through 20, 2005. Out of the 1,187 recorded patient encounters, there were 1,428 documented reasons to visit the mobile medical unit.

The top 2 reasons were for vaccinations (n=638 patients with a documented reason to visit) and prescription medication needs (n=149 patients with a documented reason to visit). Respiratory (27.8%), circulatory (27.8%), and minor injury (19.2%) were the most common diagnoses among all persons surveyed. For people with at least 1 chronic disease, asthma was the most commonly reported among people in the 0- to 21-year age group (31 [16.5%]), whereas hypertension was the most reported for the 22- to 65-year age group (99 [26.1%]) and the older than 65 years group (29 [59.2%]). The study addressed the need to consider chronic

conditions and ensure primary care accessibility for vulnerable populations during recovery from a disaster.

Ridenour et al¹⁴ conducted a needs assessment to identify the needs of evacuees in West Virginia after Hurricane Katrina. A health status questionnaire adapted from a CDC surveillance instrument and West Virginia University School of Medicine at Morgantown medical screening tool was used to assess acute conditions, chronic medical conditions, and current needs. Surveys were linked to Red Cross household registration records that included information on the following: (1) address before the disaster, (2) dwelling type and homeowner insurance, (3) total household income, (4) incurred damage from the hurricane on the home, and (5) current housing needs. Only 51% of evacuees responded to the survey. A quarter of respondents had an acute condition, and 46% had at least 1 chronic medical condition at the time of the survey. Current medical needs expressed by the evacuees included the following: dental care, 57%; eyeglasses, 34%; dentures, 28%; and medical services, 25%. The study noted that chronic disease management and medical equipment needs are often overlooked priorities among displaced populations after a disaster.

Following a cursory examination of publications in the lay press, we found hundreds of newsprint articles addressing our proposed search categories (Table 3). For example, the search terms “health disparities and disasters” resulted in 996 hits with articles. On further searching, we noted that these articles dated back to 1982. These findings differed greatly from the number of health studies found in the literature for this same category, wherein applicable studies did not emerge until around 2005. Results from newsprint hits signify a more relevant and engaged media.

DISCUSSION

A dearth of research exists on the effects of a disaster for communities disproportionately affected by health and health care disparities. Few published studies assess a disaster’s effect on chronic disease mortality and morbidity among medically underserved populations. Contrasting sharply with these glaring deficits apparent in the literature are countless articles in the lay press that have more than adequately addressed the issue of underlying health disparities in the wake of a disaster. For example, a seminal article was featured in the Washington Post just two weeks after Hurricane Katrina. The article, “At Risk Before the Storm Struck: Prior Health Disparities Due to Race, Poverty Multiply Death, Disease,” stressed that many of the disaster-affected areas had “a bunch of people who have less than optimal healthcare to begin with, and they have a large number of these diseases that people who get less than optimal healthcare end up getting” that in turn “left this high-risk group in greater peril than those with better health and access to care.”⁷²

The lay press has been at the forefront of this major public health issue, with thousands of newsprint articles discussing this issue now in circulation, while disaster epidemiology and health and health care disparities research have largely been out of touch, as seen by the paucity of peer-reviewed literature. Although it is difficult to say why, we could only speculate that the media’s ability to identify this issue as “newsworthy” suggests that it is much more conscientious and responsive to issues faced by its audience. People will continue to suffer from the effects of disasters. As a result, public health professionals must become more deliberate at accomplishing research directives that tackle real-world issues.

Health Care Needs Among Rural Disaster Populations

Following a disaster, the medical infrastructure becomes overwhelmed with acute injury and illness (the primary surge), and thought is rarely given to chronic conditions.^{2,4,12} If left untreated, preexisting chronic health problems can quickly become acute and have been linked

to increased mortality among vulnerable populations in the wake of a disaster.¹² However, it can be reasoned that chronic disease within the context of a disaster can have a bidirectional effect, whereby the initial acute disorders may advance to long-term illnesses if insufficiently treated. This effect creates a “secondary surge” in required medical treatment long after the event and exaggerates health disparities among medically underserved populations. We have defined *secondary surge* as the sudden increase in the need for long-term health care services for incident chronic diseases following a disaster. Although there is sufficient evidence, no research documenting the effects of the secondary surge following a disaster on a stressed community’s health status and health care needs exists in the literature.^{4,10,73–75} The secondary surge of chronic diseases after a disaster coupled with inherent health care disparities, as those commonly found in rural medically un-der-served areas, makes access to routine health care very difficult during the recovery phase. Health care disparities in rural settings are likely to modify the effectiveness of disaster recovery efforts for a community after a disaster, but to date, we are not aware of any literature documenting this hypothesis. We know that mortality rates attributed to cardiovascular disease, cancer, and other chronic diseases are markedly worse in rural areas, and these health disparities are exceptionally higher in the rural South, an area at high risk for disasters.^{20,33,76–78} But how do these health care disparities impact response to and recovery from a disaster, especially among medically underserved populations? New research is needed to answer this important public health question.

Limitations

The reports of several studies that examined health care disparity issues have been published in Australia,^{80–88} Europe,^{89–108} Asia,^{109–120} and South America,^{121–132} However, health care disparities and unequal access to medical care within the context of disasters are very much underappreciated global issues. One reason may be that methods used to quantify health care disparities are scarce and inconsistent. In addition, keywords including medically underserved, health disparities, and health care disparities have emerged only within the last decade as relevant topic areas. Terminology poses a problem when attempting to identify these issues in older studies of disasters. Therefore, we may have overlooked older articles that addressed these issues. Since there have been guidelines in place to quantify medically underserved areas in the United States for the past 3 decades, we used medical underservice as a proxy for health care disparities and limited our search to studies published in the United States.^{15,70,71} We may have missed research published outside of the United States and in other languages.

Logue and colleagues¹³³ noted in 1979 that the majority of disaster epidemiology literature is descriptive, and cohort studies during the extended recovery period are scarce. Nearly 30 years after this acknowledgement, little work has been done to elucidate the long-term health effects observed during disaster recovery, especially pertaining to technological disasters other than the World Trade Center collapse.^{40,53,66,68,134} Furthermore, there have been no long-term follow-up studies published in the literature that have documented chronic disease management and other health care needs among medically underserved communities after a disaster. Many longitudinal studies following the Chernobyl, Bhopal, and World Trade Center disasters have been published.^{53,135–138} None published in the English language have examined health or health care disparities and health outcomes in medically underserved populations. We observe a critical gap in the current literature examining how disaster-affected communities address the escalating burden of chronic disease in the midst of ongoing health care disparities long after the initial response efforts have ceased. Some studies provide evidence for this issue, but they have failed to identify and discuss explicit ways in which health and health care disparities impede disaster recovery efforts.^{2–4,9,14} Several studies have documented the need to study the long-term effects of psychological sequelae,^{5,74,139–152} but we propose that longitudinal research on health and health care disparities in chronic disease management after a disaster are an equally understudied research priority. Longitudinal assessment and follow-up are

especially necessary because the delayed health effects following a disaster, especially for a technological disaster, may not appear until many years later.

CONCLUSIONS

The precise mechanisms through which a community with preexisting health and health care disparities may become more susceptible to the deleterious effects of a disaster are unknown. The focus on the context of health and health care disparities before and after a disaster is important because the current literature does not capture the subsequent strain on medical resources imposed by the secondary surge of incident chronic disease in medically underserved communities. Given that chronic disease accounts for the greatest cause of morbidity in the United States, especially in rural areas, it is imperative to address chronic disease management in disaster response and identify ways to mitigate the health and health care disparities associated with populations vulnerable to disaster.

To better facilitate disaster recovery, it is vital that study designs account for effect modification by health and health care disparities for more accurate risk assessment models. Future studies should account for differences in health status and access before and after the disaster to better address the interaction between disparities in health and health care and adverse health outcomes in disaster populations. Disaster preparedness is not often a leading priority for most communities in the United States. Furthermore, lessons learned from Hurricane Katrina regarding existent health and health care disparities and increased morbidity and mortality among poor populations should be more extensively documented so that they can be used to plan for future disaster events.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Stafford Act)¹⁵³ governs the federal response to disasters within the United States, including provisions for medical care and treatment of injured victims. However, the act does not address health and health care disparities or the specific needs of communities that are medically underserved. Therefore, further research is needed to better understand the most appropriate approaches to addressing health and health care disparities in the context of the Stafford Act. Factors contributing to health and health care disparities must be accounted for in disaster planning and response to ensure that rural and vulnerable populations are equipped to be resilient during the initial and secondary surges and other disaster-related events. We believe that the secondary surge of incident chronic disease after a disaster is an underappreciated phenomenon and needs further study.

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TABLE 1

Summary of All Search Term Hits by Public Health Index for Literature Review From January 1, 1970, to May 15, 2009

Search Terms	Public Health Search Indices									
	Cambridge Scientific Abstracts	CINAHL Plus	MEDLINE (EBSCO)	PubMed-MEDLINE	Web of Science (ISI Citation)	Annual Reviews	Applied Social Sciences Index and Abstracts	The Cochrane Library	Health Reference Center-Academic	Ovid MEDLINE
Disaster	7591	4772	12 715	23 662	12 098	629	532	5407	1605	5438
Rural	43 100	15 048	80 382	65 261	77 856	1642	7301	266	11 174	78 158
Health disparities	748	1158	1549	6577	5401	666	257	84	1185	1645
Health care disparities	39	78	533	140	3086	372	3	21	51	556
Medically underserved	142	1242	4110	4067	385	78	47	4	382	4226
Disaster <i>and</i> rural	417	108	226	447	120	197	21	1	44	187
Disaster <i>and</i> health disparities	10	3	3	35	9	56	1	0	5	4
Disaster <i>and</i> medically underserved	2	7	9	30	2	5	0	0	1	9
Disaster <i>and</i> health disparities <i>and</i> rural	2	0	0	2	0	23	0	0	0	0
Disaster <i>and</i> medically underserved <i>and</i> rural	1	1	2	4	0	1	0	0	0	2
Disaster <i>and</i> health care disparities	1	0	4	22	5	7	0	0	1	4

TABLE 2
Key Articles Discussing the Effects of a Disaster on Medically Underserved Populations

Source	Study Design and Objectives	Disaster Type	Rural vs Urban	Geography	Sample	Results
Ford et al, ¹² 2007	Cross-sectional; explored how a preexisting surveillance system could be used to estimate chronic disease needs for a natural disaster	Natural	Urban	New Orleans—Metairie—Kenner, Louisiana (Metropolitan Statistical Area)	N = 1681	25.5% of adults had at least 1 chronic condition (diabetes, 9.0%; coronary heart disease, 4.6%; myocardial infarction, 3.0%; asthma, 6.3%)
Hsu et al, ⁹ 2006	Cross-sectional; assessed language, confidence, and training needs of rural physicians in Texas in responding to public health emergencies	Technological (bio-terrorism)	Rural	37 counties in north Texas	N = 841 practicing or retired physicians	Rural physicians in north Texas are serving diverse ethnic populations and need to be trained in emergency response needs of Hispanic communities.
Krol et al, ² 2007	Cross-sectional; mobile medic approach to target underserved populations residing in Mississippi after Hurricane Katrina	Natural	Urban	Gulfport-Biloxi area between September 5 and 20, 2005	N = 1205 patient encounters	Frequent reasons documented included the following: 53.7% needed vaccines; 12.6% needed prescription drugs; frequent diagnoses were as follows: respiratory, 17.1%; circulatory, 17.1%; minor injury, 11.8%; and skin conditions, 11.6%
Ridenour et al, ¹⁴ 2007	Cross-sectional; needs assessment to identify needs of evacuees after Hurricane Katrina in West Virginia	Natural	Not stated	Displaced evacuee population in West Virginia	N = 164	Acute illness, 25%; chronic medical condition, 46%

TABLE 3

Summary of Newsprint Hits in Lexis-Nexis From January 1, 1970, to May 15, 2009

Search terms	No. of Newspaper Articles
Health care <i>and</i> disasters	999
Health care <i>and</i> disasters and recovery	998
Health care <i>and</i> disasters and chronic diseases	737
Health care and disasters <i>and</i> long-term effects	983
Health care <i>and</i> disasters and rural	995
Health disparities <i>and</i> disasters	996
Disasters <i>and</i> medically underserved	172