COMPREHENSIVE REVIEW

Vulnerable Populations: Hurricane Katrina as a Case Study

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Abstract

Mitigating disaster impact requires identifying risk factors. The increased vulnerability of the physically fragile is easily understood. Less obvious are the socio-economic risk factors, especially within relatively affluent societies. Hurricane Katrina demonstrated many of these risks within the United States. These factors include poverty, home ownership, poor English language proficiency, ethnic minorities, immigrant status, and high-density housing. These risk factors must be considered when planning for disaster preparation, mitigation, and response.

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Introduction

Socio-economic inequalities in health are well-documented in the relatively affluent, industrialized world.[1–3] Components of social status, such as income, education, primary language, legal status, and ethnicity, might seem to have little to do with the impact of ostensibly random "acts of nature", such as hurricanes, floods, and earthquakes. However, ecological upheavals are not egalitarian; they disproportionately affect those who are in lower socio-economic levels.[4–8]

Many high-risk geographical areas have a disproportionately high percentage of marginalized populations; this same population is at a disadvantage for preparation, evacuation, response, and recovery. Multiple peer-reviewed articles and anecdotal reports demonstrate that Hurricane Katrina disproportionately affected the most socially vulnerable. This paper reviews disaster vulnerability and compares known risk factors to what occurred. It reviews the cultural and economic issues that put people at greater risk, factors that prevent their adequate preparation and evacuation, mechanisms by which disasters may disproportionately affect health, and specific issues of recovery.

Methods

PubMed searches were performed utilizing the combinations of "Disaster" AND "Vulnerability", "Hurricane" AND "Vulnerability", and "Hurricane Katrina". These searches yielded a total of 901 articles. The titles, and abstracts if available, were scanned. Those that described populations at increased risk were selected and reviewed. Psychological trauma, substance abuse, and post-traumatic stress disorder issues were not reviewed due to the breadth of the topics. Article bibliographies also were utilized for research and selection.

Population characteristics that demonstrated an increased risk of poor physical or social outcomes were identified, and comparisons were made with past anecdotal and epidemiological studies. A total or 228 articles and/or texts were selected and reviewed. Additionally, data were obtained from online reports of the United States Census.

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Results

Pre-Hurricane Risks

Those of lower socio-economic standing tend to live in more polluted, less secure, and high-risk environments.[5,7–13] It has been suggested that their environment receives less protection than other regions, creating a vicious cycle of ever-increasing risk.[5,14] Independent of location and environment, structurally poor quality housing often is a proxy for poverty and ethnic minorities, and is more likely to collapse during a disaster.[9,10,15,16]

These risk factors were at play prior to Hurricane Katrina.[17,18] In 2003, Cutter developed a nationwide map of social risk within the US; New Orleans was one of the more extreme high-risk areas, landing in the bottom three percentile of the nation.[19] Hurricane Katrina validated these assumptions; the lowest lying areas of New Orleans were heavily black and poor, and generally the worst hit.[5,19] Utilizing year 2000 census data, Logan found that the damaged areas of New Orleans were disproportionately black (46%) and below the poverty line (21%) compared to undamaged areas (26% and 15%, respectively).[20] It is not surprising that a survey reported that some inhabitants from the worst neighborhoods perceived that they were deliberately targeted, and in some cases believed that levees were deliberately destroyed for the benefit of more affluent neighborhoods.[21]

Disaster Preparation

Public warnings are intended to help mitigate disaster impacts, and commonly are dissembled through the media. However, for warnings to be effective, they must be understood and believed.[22–25] In the US, about 8% of the overall population does not speak English well and in some major cities, that number is >50%.[26] Poverty is somewhat proportional to family size,[28] and families typically evacuate as a unit.[29,30] The large family is simultaneously more likely to be poor and have the social complexities of coordinating the preparation and evacuation of multiple people across generations. Additionally, distrust of government authority, common to many socially disadvantaged groups, also has been shown to impede evacuation and preparation decision-making.[10,21,22,31–34]

Studies demonstrated that all of these known issues were at play in New Orleans. Census Bureau information documented >150,000 Latinos in New Orleans, and more than one-third of them did not speak English well.[26] Anecdotal reports suggest that language and cultural barriers prevented Latinos from evacuating.[35] Historically, ethnic minorities and immigrants have been distrustful enough of authorities that they often avoid shelters;[36] anecdotal reports suggest that occurred following Katrina.[35] While there were many other factors that impeded evacuation, shelter surveys found that among those who did understand the pre-Katrina warnings, many discounted or ignored them due to distrust of the authorities.[22,23,30,35,37,38]

For those who understood and accepted the warnings and are able to coordinate a decision on preparation within their social unit, preparation and evacuation consume economic resources that are not available to everyone.[22] Those that chose to attempt to ride out the storm at home had to purchase plywood, water, nails, extra food, and water; requiring the funds for purchase, as well as someone available to shop and physically fit enough to work. Owners of rental property may be less likely to take on the added time and expense, while tenants may be unable to, or prohibited from, attempting any structural work.

High density housing, poor quality construction, rental units, and mobile homes are more common in poor neighborhoods than wealthier ones.[8] These property types are all known to be risk factors for injury.[10,12,39,40] There is no information available on how construction quality affected the health outcomes from Hurricane Katrina, but it is known that rental stock was impacted disproportionately, with damaged areas having a higher percentage of renters (46%) compared to the undamaged areas (31%).[20]

Evacuation

Evacuation not only requires a method of transportation, but involves the risk of missing work, the cost of food, and a place to stay. The year 2000 Census numbers demonstrate that while 90% of US households may own a vehicle, the number drops to 79% when looking at rental households and to 77% when considering minority households.[41] The numbers drop for minority renters, with only 65% owning a vehicle. In 1992, when New Orleans attempted to prepare for Hurricane Andrew, transportation problems were obvious.[5] This threat was noted again in 2004, when the Federal Emergency Management Agency (FEMA)-sponsored simulation drills and subsequent preparations for Hurricane Ivan demonstrated the critical lack of transportation.[42–45] The mayor acknowledged that about 100,000 inhabitants were without transportation.[45] Census numbers demonstrated that the region-at-risk was likely to have >200,000 persons without access to a vehicle.[46] A closer look also would have demonstrated that minorities were three times as likely as whites not to have access to a vehicle.[41] In addition to the poor and minorities, the elderly and disabled are much less likely to have access to vehicles than the general population,[47–49] particularly those who need assistance.[50] Other well known populations with severe transportation problems are nursing home residents and tourists.[49] Once again, the predictions held true for Katrina; multiple surveys demonstrated that the poor and minorities had problems with transportation.[21,23,30,37,38,49] Only 21% of the >280 nursing homes evacuated and >215 people died in nursing homes.[50,51]

Surviving

There are multiple anecdotal, post-Katrina reports of severe impact on those with hypertension,[53] diabetes,[54,55] end-stage renal disease,[56,57] chronic metabolic illnesses,[58] and other chronic diseases.[59,60] These chronic illnesses are more prevalent within lower socio-economic groups. As expected, the mortality during Katrina was skewed toward the elderly, with 64% of deaths occurring in persons >65 years of age.[61] The male to female distribution of deaths was almost even, which might seem odd, since females often are considered at greater risk than males,[8,62,63] and surveys had demonstrated that, in New Orleans, there were more disabled elderly females than males.[64] Not only does the elder-

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ly female population seems to be physically more fragile than the elderly male and are more likely to be poor,[28] but also there are far more elderly females than males. As Enarson wrote, "an aging population is a feminizing population".[65] However, past epidemiological reviews of flood deaths found that males tended to predominate.[66] It is reasonable to think that the elderly deaths were due to a mix of causes, such as direct trauma, loss of health care, and flooding/drowning, and that this may account for this apparent difference from predictions. At first glance, the racial distribution seems to be disproportionately white (44% of deaths versus 36% of the population), however, there were a disproportionate number of elderly whites in New Orleans,[64] and once the demographics are corrected for age and race, blacks are found to be disproportionately affected.[67]

Disaster mortality commonly is measured in the immediate aftermath, but the lasting impact often leads to a large number of "indirect deaths".[68,69] Shelters had limited dietary choices, and those who could afford better housing did not stay long in the shelters. It is likely that diet limitations had a negative effect on those with chronic conditions who could not afford to go elsewhere, such as those with diabetes, end-stage renal disease, heart disease, and/or asthma.[46,70–73]

The loss of healthcare infrastructure has impacted many vulnerable populations. Clinics for HIV/AIDS patients have been difficult to find, and are much less capable than before the hurricane.[74] Similar access problems have been noted for adults with sickle cell disease[75] and other populations with chronic illnesses.[46,55] A review of death notices following Katrina has demonstrated substantial increases in the mortality rate following Katrina,[76] but the demographic information is very incomplete.

Recovery

Those without resources are more likely to end up in shelters and remain in them. Home repairs require money. Public housing units and rental units tend to be repaired more slowly.[22,65] The poor and ethnic minorities are less likely to have insurance,[5] and also more likely to lose their jobs.[22] Work-for-pay programs may split families, with one going "where the work is" leaving the spouse to fend until their return. Even as the recovery phase evolves, the lower paying jobs and underground economy often is affected disproportionately. Service workers often are the last to return to work. The power and autonomy of groups may affect the quality, efficiency, and quantity of government assistance.[13,38]

Undocumented aliens may have even fewer options; it was not certain how safe they would be from deportation in shelters.[35,77,78] Governmental agencies have few bilingual response personnel; it is difficult to negotiate healthcare and relief systems in the best of circumstances and language and education barriers, social distances, and differing cultural values only can add to the difficulties.[5,32,79] As noted above, many minorities tend to live in large, multi-family households, resulting in discrimination when assistance is based on "household" units.[80] At the other extreme, an added burden is levied on single parent households, predominantly female, who must chose between their care responsibilities and standing in lines to acquire needed resources.

Surveys have found that renters, who were disproportionately impacted, were far less likely to find their own housing after Katrina, and that blacks were nearly four times more likely than displaced whites to lose their jobs, with the greatest unemployment among those with the worst paying jobs (and most likely, the least resources).[20] As shown in past disasters,[81] post-disaster housing is at a premium, and to this date, there is a shortage of rental housing in New Orleans.[82]

Discussion

Disasters caused by environmental hazards repeat year after year, century after century. The pattern of increased risk for those who are impoverished, ethnic minorities, or otherwise marginalized within a society was repeated following Hurricane Katrina. The similarities of the high-risk populations between disasters and day-to-day health disparities are striking.

Disaster preparation in the US is driven heavily by the high drama of bioterrorism and the video media potential for mass casualties. Yet, the avoidable morbidity and mortality exists with much less fanfare among the fragile. Stockpiling of critically needed medications and pre-establishing referral pathways may go a long way to mitigate the risk for the chronically ill.

One potentially beneficial tool is the increasing ability to map risks. Perhaps risk mapping of social vulnerabilities, as done by Cutter,[19] also will lead to a greater knowledge of risk factors, and thereby, spill over to interventions that generally improve health and well-being. Knowing which locations have high numbers of elderly, children, or specific language or cultural groups may allow for more efficient and effective disaster preparation and management. This information was available prior to Katrina, but perhaps, the application of this technology still is a work in progress.[83] Additionally, warnings could be better customized for the recipient populations—warning systems for tropical cyclones have been demonstrated to drastically reduce disaster impact.[84]

For these events with a warning period, such as hurricanes, transportation needs should be more realistically addressed. Post-disaster transportation resources are not commonly considered, nor are they currently well integrated into planning.

Conclusions

It has been suggested that natural disasters provide an extra insight into our culture and society.[7,22] Televised miserable post-disaster living conditions, acute injury, and death are a fascination for those watching in comfort. The socio-economic disparities that contributed to this suffering are not always acknowledged or considered. Disaster planning should emphasize those at greater risk, and understand that many "risks" are societal; not physiological.

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