

# Disparity in disaster preparedness between racial/ethnic groups

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**Keywords:** disaster, preparedness, race/ethnicity, vulnerable, disparity

**Abbreviations:** OR, odds ratio; BRFSS, Behavioral Risk Factor Surveillance System

**Objective:** The objective of this study was to examine the association between race/ethnicity (including language subgroups among Hispanics) and disaster preparedness among Behavioral Risk Factor Surveillance System (BRFSS) survey respondents.

**Methods:** BRFSS data were obtained for eight states which implemented the optional general preparedness module from 2006 through 2010. Three dependent variables were analyzed including presence of four preparedness items (i.e., food, water, flashlight, and radio), emergency evacuation plan, and 3-d supply of medication. Primary independent variable included race/ethnicity accounting for language of survey. Data were analyzed in 2011 and accounted for BRFSS sampling design.

**Results:** Black (OR = 0.66, 95% CI = 0.56, 0.79), English-speaking Hispanic (OR = 0.48, 95% CI = 0.34, 0.69) and Spanish-speaking Hispanic respondents (OR = 0.20, 95% CI = 0.13, 0.29) were less likely than non-Hispanic white respondents to live in a household in which all members requiring medication had a 3-d supply. Results varied regarding presence of four preparedness items and an emergency evacuation plan.

**Conclusions:** Racial/ethnic minority groups were less likely to have medication supplies but only Spanish-speaking Hispanics were less likely to have an emergency evacuation plan than white respondents. Public health officials can use these findings to support targeting racial/ethnic minorities to increase the presence of preparedness items important to mitigate the effects of disasters, with particular emphasis on medication supplies and Spanish-speaking Hispanics.

## Introduction

Manmade disasters (e.g., bioterrorist attacks) and natural disasters (e.g., hurricanes, tornados, floods, fires, extreme heat, and disease pandemics) are priority public health issues due to the associated physical and mental impact on the affected populations.<sup>1</sup> Impacts of disasters include acute injuries and illnesses, communicable disease outbreaks, complications from chronic disease, psychological distress, loss of property, and death. While all members of populations are affected by disasters, research findings show that racial and ethnic minorities are less likely to evacuate and more affected by disasters.<sup>2–4</sup> During Hurricane Katrina, the large number of people seeking safety in designated shelters were disproportionately black.<sup>5</sup> In addition, the mortality rate for blacks was 1.7 to 4 times greater than that of whites for all people  $\geq 18$  y in Orleans Parish.<sup>6</sup> Similarly, Hispanics suffered disproportionately from psychological distress after California earthquakes and the September 11th terrorist attacks.<sup>7–9</sup>

Reasons for the increased vulnerability of racial and ethnic minorities have focused on class issues such as socioeconomic

differences and lack of resources; however, there are issues specific to race and ethnicity that contribute to the increased vulnerability such as cultural and language barriers, distrust of warning messengers (e.g., government authority), lower perceived risk from emergencies, preference for particular information sources (e.g., friends and family), and lack of preparation.<sup>3</sup> Cutter et al. developed an index of social vulnerability to environmental hazards using county-level socioeconomic and demographic data which highlighted the importance of race/ethnicity.<sup>10</sup> The index included 11 independent factors, four of which were related to race/ethnicity. The four race/ethnicity factors accounted for 19.1% of the variation in the index among the counties. Eisenman et al.<sup>11</sup> examined variations in perceptions that the public health system will respond fairly to a bioterrorist event, regardless of race/ethnicity. They found that black respondents reported the lowest perceived fairness (63.0%) among race/ethnic groups and had lower perceived fairness compared with whites (OR = 0.45, 95% CI = 0.26, 0.79). Another study examined the cultural appropriateness of emergency preparedness messages and materials for economically disadvantaged blacks and Hispanics

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**Table 1.** Demographic characteristics of BRFSS survey respondents by race/ethnicity, 8 US states, 2006–2010 (n = 63,402)

Characteristic	Overall (n = 63,402) %	Non-Hispanic White (n = 46,519) %	Non-Hispanic Black (n = 8,695) %	English-Speaking Hispanic (n = 1,366) %	Spanish-Speaking Hispanic (n = 387) %	p*
Sex						< 0.001
Male	47.9	48.0	45.7	54.3	59.4	
Female	52.1	52.0	54.3	45.7	40.6	
Age (years)						< 0.001
18–64	83.5	81.3	88.3	91.6	99.3	
≥ 65	16.5	18.7	11.7	8.4	0.7	
Education						< 0.001
≤ High school	42.8	39.0	50.7	49.7	91.4	
Some college	26.5	27.2	25.9	26.6	3.8	
College graduate	30.7	33.8	23.4	23.7	4.8	
Marital status						< 0.001
Married/Living as married	63.6	69.1	43.7	62.9	78.7	
Not married	36.4	30.9	56.3	37.1	21.3	
Household income						< 0.001
< \$35,000	39.9	33.5	57.2	45.4	89.5	
\$35,000 - \$74,999	32.5	34.3	28.2	32.6	10.2	
≥ \$75,000	27.6	32.2	14.6	22.0	0.3	
Number in household						< 0.001
1–2	54.6	58.0	47.4	41.0	33.9	
3–4	34.6	33.1	38.6	40.4	37.2	
> 4	10.8	8.9	14.0	18.6	28.9	
Healthcare plan						< 0.001
No	17.1	13.5	23.0	27.0	26.3	
Yes	82.9	86.5	77.0	73.0	73.7	
Perceived Health Status						< 0.001
Excellent	19.6	20.9	15.2	23.6	8.6	
Very good	32.1	34.0	27.3	29.9	12.9	
Good	30.4	28.9	34.6	31.0	43.7	
Fair/Poor	17.9	16.2	22.9	15.5	34.8	

\*Chi-square test (weighted)

in Maryland and found a large disparity in the amount of culturally tailored information available to these populations.<sup>12</sup> However, Fothergill et al. go further and conclude in their review that “cultural ignorance, ethnic insensitivity, racial isolation and racial bias in housing, information dissemination, and relief assistance” also explain the increased vulnerability of racial and ethnic minorities that socioeconomic factors cannot.<sup>3(p169)</sup>

The September 11th terrorist attacks, the Gulf Coast hurricanes, California wildfires, and the threat of H5N1 and H1N1 pandemic influenza transformed the field of disaster preparedness—making it a public health priority for the US government.<sup>13</sup> As such, assessments of vulnerable populations’ preparedness to sustain or minimize the impact of a disaster (man-made or natural) are critical since different approaches are needed

to improve preparedness among these populations. Previous studies including an examination of differences in preparedness by race/ethnicity have yielded mixed results.<sup>14–16</sup> The objective of this study was to examine the association between race/ethnicity (including language subgroups among Hispanics) and disaster preparedness among Behavioral Risk Factor Surveillance System (BRFSS) survey respondents from 2006 through 2010.

## Methods

### Survey and sample

The methods have been previously described elsewhere.<sup>17</sup> Cross-sectional data were obtained from the 2006 through

**Table 2.** General preparedness among BRFSS survey respondents by race/ethnicity, 8 US. States, 2006–2010 (n = 63,402)

Item	Race/Ethnicity					p*
	Overall (63,426)	White (n = 52,832)	Black (n = 8,708)	English-speaking Hispanic (n = 1,467)	Spanish-speaking Hispanic (n = 395)	
All 4 preparedness items; %	42.1	42.5	41.4	40.0	37.1	0.359
3 d supply of water; %	55.4	53.6	60.1	57.2	70.7	< 0.001
3 d supply of food; %	84.3	86.2	80.1	78.0	66.2	< 0.001
Battery-operated radio; %	77.8	80.1	72.6	70.3	57.9	< 0.001
Flashlight with batteries; %	94.8	97.1	89.2	91.3	74.0	< 0.001
Evacuation plan; %	24.6	23.8	27.0	27.8	21.9	0.003
3 d supply of medication**;%	89.0	91.5	84.0	81.0	50.0	< 0.001

\*Chi-square test (weighted); \*\*Only for households in which a member was taking prescribed medication

2010 BRFSS surveys.<sup>18</sup> BRFSS is an ongoing, random-digit-dialed telephone survey of the non-institutionalized US civilian population 18 y or older conducted by state health departments. BRFSS includes information regarding demographics, health status, health behaviors, preventive health practices, health care access, and risk factors for certain chronic diseases, infectious diseases, and injuries. The questionnaire consists of core modules, optional modules, and state-added questions. Eight states implemented the optional general preparedness module (11 questions) in English and Spanish from 2006 through 2010. These states included Delaware (2007; n = 3,773), Georgia (2008; n = 5,453), Louisiana (2007; n = 6,330), Mississippi (2009; n = 10,873), Montana (2006, 2008, 2010; n = 18,108), Nevada (2006; n = 3,119), North Carolina (2010; n = 11,452) and Tennessee (2006; n = 4,318). Analyses were limited to Non-Hispanic white, Non-Hispanic black, and Hispanic respondents in these eight states (n = 63,426). Response rates ranged from 41% to 61.4% in the eight states during the five years.<sup>19</sup>

#### Dependent variables

Three dependent variables assessing household preparedness were included in the analyses. The first dependent variable was based on four questions assessing the household's presence of a 3-d supply of water, 3-d supply of non-perishable food, a battery-operated radio with working batteries, and a flashlight with working batteries. Specifically, these questions were: "Does your household have a 3-day supply of water for everyone who lives there?," "Does your household have a 3-day supply of non-perishable food for everyone who lives there?," "Does your household have a working battery operated radio and working batteries for your use if the electricity is out?," and "Does your household have a working flashlight and working batteries for your use if the electricity is out?" A dichotomous variable was created for having all four preparedness items above compared with having three or fewer items. The second dependent variable represents presence of an emergency evacuation plan and was based on the question, "Does your household have a disaster evacuation plan, a written plan for how you will leave your home, in case of a large-scale disaster or emergency that requires evacuation?" The third dependent variable represents having a 3-d supply of prescription medication and was based

on the question, "Does your household have a 3-day supply of prescription medication for each person who takes prescribed medicines?" Respondents in households in which no one was taking prescription medications (n = 5,862) were excluded from the analyses for this dependent variable. Presence of individual household items was also examined.

#### Independent variables

The key independent variable was race/ethnicity and included Non-Hispanic white (white), Non-Hispanic black (black), and Hispanics. Other race/ethnic groups were excluded due to low sample size. To examine the association between preparedness and acculturation using language as a proxy for acculturation, Hispanics were further divided into English-speaking Hispanics and Spanish-speaking Hispanics based on preferred language of the survey. Acculturation has been shown to be associated with various health behaviors and preparedness is considered a health behavior.<sup>20–26</sup> Additional independent variables include self-reported general health (excellent, very good, good, fair/poor), and health insurance (yes or no), age (18–64, ≥ 65 y). Demographic information include sex, education (≤ high school, some college, college graduate), marital status (married/living as married, unmarried), household income (< \$35,000, \$35,000–\$74,999, ≥ \$75,000), and number living in household (1–2, 3–4, ≥ 4).

#### Statistical analysis

Univariate analysis (i.e., percents) was performed to describe the characteristics of the study population. Bivariate analysis (i.e., chi-square test) was performed to examine the associations between the three dependent variables and the various study population characteristics including race/ethnicity. Three multiple logistic regression models were generated to examine the independent associations between race/ethnicity and the three dependent variables, respectively, controlling for covariates. All models controlled for age, sex, education, marital status, household income, number living in household, health status, and health insurance. BRFSS data are weighted for the characteristics of the sample design – disproportionate sampling by geographic and density strata and the number of telephones and adults in the household.<sup>27</sup> BRFSS data include a variable indicating the final weight assigned to each respondent. All analyses were conducted using Stata (Stata, version 12) to account for the weighted data.<sup>28</sup>

Specifically, STATA's *svy* and *svyset* commands were used to calculate point estimates and 95% confidence intervals while accounting for the complex sampling design.

## Results

A total of 63,402 white (73.1%), black (21.0%), English-speaking (4.1%), and Spanish-speaking (1.8%) respondents completed the general preparedness module during 2006 through 2010 in eight states. Nearly 84% of respondents were age 18–64 y and most respondents were married or living as married (63.6%), lived in a household with  $\leq 4$  people (89.2%), had at least some college education (57.2%), and had health insurance (82.9%) (Table 1). Associations between all characteristics and the respondents' race/ethnicity were statistically significant.

Among all respondents, 42.1% of households had all four preparedness items, 24.6% had an emergency evacuation plan, and 89.0% of respondents lived in households in which each member requiring prescription medication had a 3-d supply (Table 2). There was no significant association between race/ethnicity and having all four preparedness items. There was a significant association between race/ethnicity and the four individual preparedness items. Spanish-speaking Hispanics were the group with the lowest reported level of three of the four preparedness items. When we examined preparedness further by race/ethnicity, we found that 23.8%, 27.0%, 27.8%, and 21.9% of white, black, English-speaking Hispanic and Spanish-speaking Hispanic respondents, respectively, reported having an emergency evacuation plan ( $P = 0.003$ ) and 91.5%, 84.0%, 81.0% and 50.0% of white, black, English-speaking Hispanic and Spanish-speaking Hispanic respondents, respectively, lived in households in which each member requiring prescription medication had a 3-d supply ( $P < 0.001$ ). There was a significant association between race/ethnicity and self-reported preparedness level with white respondents reporting the highest percentage of being "very prepared." Pairwise comparisons between the four race/ethnic groups and self-reported preparedness level revealed significant associations between all groups except between black and English-speaking respondents.

Multivariate analyses showed that black (OR = 0.66, 95% CI = 0.56, 0.79), English-speaking Hispanic (OR = 0.48, 95% CI = 0.34, 0.69) and Spanish-speaking Hispanic (OR = 0.20, 95% CI = 0.13, 0.29) respondents were less likely to live in a household in which all members requiring medication had a 3-d supply than non-Hispanic white respondents (Table 3). Multivariate analyses also showed that Spanish-speaking Hispanic respondents were less likely to have an emergency evacuation plan than white respondents (OR = 0.67, 95% CI = 0.47, 0.97) whereas English-speaking Hispanic (OR = 1.35, 95% CI = 1.07, 1.69) and black (OR = 1.13, 95% CI = 1.01, 1.27) respondents were more likely to have an emergency evacuation plan than white respondents, respectively (Table 3). There was no significant association between race/ethnicity and presence of all four preparedness items, after controlling for potential confounding variables.

Multivariate analyses also showed associations between various levels of covariates and all three dependent variables (Table 3).

## Discussion

Analyses of 2006–2010 BRFSS data revealed a large disparity in 3-d supplies of medication for each household member requiring medication for black, English-speaking Hispanic and Spanish-speaking Hispanic respondents compared with white respondents. Black and English-speaking Hispanic respondents were more likely to have an emergency evacuation plan than white respondents. Also, of the racial and ethnic groups, the presence of all four household preparedness items, an emergency evacuation plan, and a medication supply was lowest among Spanish-speaking Hispanics. Spanish-speaking Hispanics were the group with the lowest reported level of three of the four individual preparedness items. The discrepancy in preparedness between English-speaking and Spanish-speaking Hispanics may be due to insufficient disaster preparedness materials available in languages other than English.

The finding that black, English-speaking Hispanic and Spanish-speaking Hispanic respondents were less likely than white respondents to live in a house in which all members requiring medication had a 3-d supply of medication has important implications. Multivariate analyses controlled for variables that were associated with both race/ethnicity and medication supply (i.e., education, household income, and healthcare plan) indicating that the difference in medication supplies is not due to traditional socioeconomic status factors. Possible reasons for the disparity include factors such as proximity to pharmacy, access to pharmacy (i.e., transportation), and perhaps differences in level of prescription drug coverage in health insurance plans. This disparity in medication supplies is somewhat consistent with a previous study by Heslin et al. examining medication supplies among a sample of California veterans and non-veterans.<sup>29</sup> Consistent with the present study, Heslin et al. found that Latino respondents were more likely than white respondents to have medication supplies; however, contrary to the present study's findings, Heslin et al. also showed that black respondents were less likely than white respondents to have medication supplies. The Heslin et al. study measured 2-week medication supplies whereas the BRFSS survey examined 3-d medication supplies.

Black and English-speaking Hispanic respondents were more likely to have an emergency evacuation plan than white respondents. This difference may reflect an acknowledgment among these groups that they have historically struggled to receive emergency and relief services post disaster and been severely impacted by natural disaster, both of which are evidence by the impact of Hurricane Katrina on racial and ethnic minorities.<sup>3,5-9</sup> Reasons for this difference in household emergency evacuation plans warrant further study. This finding is consistent with two previous studies based in Los Angeles County.<sup>14,15</sup> These studies found that, similar to the present study, black respondents had a greater odds of possessing preparedness items and an emergency evacuation plan than white respondents. However, the two studies

**Table 3.** Multivariate logistic regression results for general preparedness among BRFSS survey respondents, 8 US states, 2006–2010 (n = 63,402)

Characteristic	4 preparedness items*		Emergency evacuation plan		3-d supply of medication†	
	OR	95% CI	OR	95% CI	OR	95% CI
Sex						
Male	1.00	—	1.00	—	1.00	—
Female	0.67	0.62, 0.72	0.94	0.87, 1.02	0.87	0.76, 0.99
Age (years)						
18–64	1.00	—	1.00	—	1.00	—
≥ 65	1.30	1.20, 1.40	1.22	1.11, 1.33	3.11	2.60, 3.72
Education						
≤ High School	1.00	—	1.00	—	1.00	—
Some college	0.95	0.87, 1.04	0.93	0.84, 1.03	1.25	1.06, 1.47
College graduate	0.79	0.72, 0.87	0.77	0.69, 0.85	1.25	1.05, 1.50
Marital status						
Married/Living as Married	1.00	—	1.00	—	1.00	—
Not Married	1.01	0.93, 1.09	0.96	0.88, 1.06	0.88	0.75, 1.03
Household income						
< \$35,000	1.00	—	1.00	—	1.00	—
\$35,000 - \$74,999	1.10	1.00, 1.21	0.86	0.78, 0.96	1.57	1.32, 1.87
≥ \$75,000	1.22	1.08, 1.37	0.73	0.64, 0.84	2.48	1.96, 3.14
Number in household						
1 – 2	1.00	—	1.00	—	1.00	—
3 – 4	0.89	0.82, 0.97	1.11	1.02, 1.22	0.75	0.65, 0.87
> 4	0.91	0.78, 1.06	1.54	1.32, 1.81	0.71	0.56, 0.90
Health care plan						
No	1.00	—	1.00	—	1.00	—
Yes	1.09	0.98, 1.22	0.98	0.86, 1.11	1.56	1.32, 1.84
General Health						
Excellent	1.00	—	1.00	—	1.00	—
Very Good	0.88	0.79, 0.97	0.82	0.73, 0.92	1.28	1.05, 1.57
Good	0.83	0.75, 0.93	0.90	0.80, 1.01	1.32	1.08, 1.61
Fair/Poor	0.79	0.70, 0.90	0.87	0.76, 1.00	1.46	1.17, 1.82
Race/Ethnicity						
White	1.00	—	1.00	—	1.00	—
Black	1.02	0.92, 1.14	1.13	1.01, 1.27	0.66	0.56, 0.79
English-speaking Hispanic	1.07	0.85, 1.34	1.35	1.07, 1.69	0.48	0.34, 0.69
Spanish-speaking Hispanic	0.92	0.63, 1.35	0.67	0.47, 0.97	0.20	0.13, 0.29

\*Includes 3 d supply of food, 3 d supply of water, radio with batteries, and flashlight with batteries; \*\*Chi-square test (weighted); † only among respondents with household members who require medication

varied in the statistical significance of the effect size and one study examined adoption of new preparedness behaviors in response to terrorism. A third previous study by Ablah et al.<sup>16</sup> analyzed 2006 BRFSS preparedness data and did not find a significant association between preparedness and race/ethnicity. However, the study by Ablah et al. did not examine presence of an emergency evacuation plan independently. The authors defined preparedness as having at least 5 of the following 6 items: 3-d supplies of water, food,

medication (for all household members requiring medication), radio, flashlight, and emergency evacuation plan as compared with the present study which defined three separate dependent variables using these 6 preparedness items. In the present study, we created separate dependent variables for disaster supplies, medication, and evacuation plans because they serve different purposes and they require various levels of input from household members (i.e., emergency evacuation plan). Also, while these previous



studies examined preparedness levels by race/ethnicity, none of them examined subgroups of Hispanics identified by language preference and none examined medication supply separately.

The study has several limitations which should be noted. First, BRFSS relies on self-reported data and, therefore, may include some misclassification of preparedness levels and race/ethnicity. However, the misclassification is most likely non-differential and underestimates the difference in preparedness between racial and ethnic groups. Also, the BRFSS data used in the analyses are limited to adults living in households with a landline telephone in eight states with unique distributions of race and ethnicity, and, therefore, results may not be generalizable to the entire US population. Findings could also have been affected by the low response rates. For the five years of data, response rates in the eight states ranged from 41% to 61.4% and the median response rate was 50.1%.<sup>19</sup> However, BRFSS uses poststratification weights to reduce the impact of nonresponse.<sup>30-34</sup> In addition, the number of Spanish-speaking Hispanics was quite low, limiting our ability to test for differences in preparedness with other groups. Finally, the use of a single item (language of survey) was not the ideal proxy for acculturation among Hispanics and translation of the English version of the BRFSS questionnaire into Spanish may have led to artificial differences by survey language. However, Cruz et al. validated proxy measures of acculturation using the National Alcohol Survey's 12-item acculturation scale as the gold standard and found that interview language was a more valid single measure of acculturation than generation and proportion of life in the US and only slightly less valid than the 3- and 4-item proxy measures of acculturation.<sup>35</sup>

Public health officials can use these findings as evidence that racial and ethnic minorities should be targeted to increase the presence of preparedness items important to mitigate the effects of disasters, with particular emphasis on medication supplies and Spanish-speaking Hispanics. Given cultural values and traditions affect public health messaging, effective and culturally relevant health risk communication about disasters in various languages is vital to improving preparedness levels among vulnerable populations, including racial and ethnic populations.<sup>36-38</sup> Research on pandemic influenza preparedness has demonstrated that effective health risk communication is important to reach vulnerable populations.<sup>39</sup> In 2008, the Centers for Disease Control and Prevention (CDC) convened a meeting of public health experts to discuss strategies to protect vulnerable

populations (including racial and ethnic minorities) during a pandemic.<sup>39,40</sup> The panel's recommendations were previously reported in the context of medically vulnerable populations and can also be applied to racial and ethnic minority populations.<sup>14</sup> Recommendations included strengthening personal relevance of communications by adapting messaging to the language, cultural values, and daily life conditions of the target population and by using concrete message imagery rather than statistics. The panel also advocated building self-efficacy and trust by involving trusted members of the community, providing clear advice on how they can minimize effects, and to be transparent about potential negative effects.

Eisenman et al.<sup>41</sup> conducted an experimental, community-based, participatory research study to develop and evaluate a disaster education preparedness program targeting Hispanics. The program was consistent with the CDC panel's recommendations and utilized lay health workers to reach the target population. The lay health advisors or *promotoras* were trusted members of the Hispanic community who were trained to deliver culturally competent health information regarding disaster preparedness. Participants who received the test intervention delivered by the lay health advisors showed greater improvement in stockpiling water and food and developing a communication plan than participants in the control group. Similar programs can be implemented in black communities to improve disaster preparedness.

## Conclusions

These analyses provide valuable findings from a systematic, ongoing telephone-based survey to approximately 350,000 US residents each year. Analysis of BRFSS data showed that racial and ethnic minority groups were less likely to have medication supplies but only Spanish-speaking Hispanics were less likely to have an emergency evacuation plan than white respondents. Public health officials can use these findings to support targeting racial and ethnic minorities to increase the presence of preparedness items important to mitigate the effects of disasters, with particular emphasis on medication supplies and Spanish-speaking Hispanics.

## Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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