# Racial Disparities in Exposure, Susceptibility, and Access to Health Care in the US H1N1 Influenza Pandemic

Sandra Crouse Quinn, PhD, Supriya Kumar, PhD, MPH, Vicki S. Freimuth, PhD, Donald Musa, DrPH, Nestor Casteneda-Angarita, MS, and Kelley Kidwell, BS

*Objectives.* We conducted the first empirical examination of disparities in H1N1 exposure, susceptibility to H1N1 complications, and access to health care during the H1N1 influenza pandemic.

*Methods.* We conducted a nationally representative survey among a sample drawn from more than 60 000 US households. We analyzed responses from 1479 adults, including significant numbers of Blacks and Hispanics. The survey asked respondents about their ability to impose social distance in response to public health recommendations, their chronic health conditions, and their access to health care.

*Results.* Risk of exposure to H1N1 was significantly related to race and ethnicity. Spanish-speaking Hispanics were at greatest risk of exposure but were less susceptible to complications from H1N1. Disparities in access to health care remained significant for Spanish-speaking Hispanics after controlling for other demographic factors. We used measures based on prevalence of chronic conditions to determine that Blacks were the most susceptible to complications from H1N1.

*Conclusions.* We found significant race/ethnicity-related disparities in potential risk from H1N1 flu. Disparities in the risks of exposure, susceptibility (particularly to severe disease), and access to health care may interact to exacerbate existing health inequalities and contribute to increased morbidity and mortality in these populations. (*Am J Public Health.* 2011;101:285–293. doi: 10.2105/AJPH.2009.188029)

In 2008, Blumenshine et al. proposed a model in which differences in social position (e.g., income, race/ethnicity) could cause disparities in exposure to influenza, unequal levels of susceptibility to illness if exposed, differential access to prophylaxis before disease develops, and differential access to treatment after disease develops.[1] The model held that these disparities could synergistically lead to unequal levels of morbidity and mortality.[1] We used this model to examine disparities in the 2009 H1N1 influenza pandemic.

As of October 2009, the Centers for Disease Control and Prevention (CDC) had recorded widespread H1N1 influenza activity in 46 states, and visits to health care facilities had increased sharply.[2] There were also increasing reports of racial/ethnic disparities in H1N1 complications and hospitalization rates.[3–11] Boston and Chicago officials reported an overrepresentation of Blacks and Hispanics (and Asian/Pacific Islanders in Chicago) among hospitalized cases.[3,9] Oklahoma documented a disparity in race/ethnicity specific incidence rates per 100 000 for hospitalized cases; among the 1081 cases reported, the rates were highest for Blacks (55%) and Native Americans (37%) and lowest for Whites (26%).[12]

Speculation about causes of this disproportionate impact has focused on crowded living conditions, differential exposure, lower income, distrust of government, and susceptibility to complications caused by chronic diseases.[3,8,9,11] We used the model of Blumenshine et al. (further described below) in an effort to understand this pandemic and prevent unnecessary suffering as a result of it.

## DISPARITIES IN EXPOSURE

According to the model of Blumenshine et al. reasons for disparities in influenza exposure may include crowding, occupations, reduced ability to work at home, and dependence on public transportation.[1] During previous pandemics, crowding and poverty were related to the influenza attack rate.[13,14] Some have speculated that disparities in H1N1 transmission in the current pandemic correlate with crowding but not necessarily with poverty.[9]

Low-income and minority workers may have difficulty in adhering to directives to stay home from work. A 2006 study found that low-income and minority populations would have difficulty complying with social-distancing recommendations.[15] According to the US Census Bureau, of the approximately 11.3 million people aged older than 16 years who worked at home from 1999 through 2005, 82% were White, 6% were Black, 6% were Hispanic/Latino, and 3.8% were Asian.[16] Disparities in exposure could also result from dependence on public transportation.[1] Minorities account for 63% of public transport users (33% Black, 5.5% Asian, and 14.3% Hispanic/Latino).[17] Although Blacks represent approximately 12.4% of the US population, they are overrepresented among riders of public transportation, underscoring this factor as a possible source of disparity in exposure.[16,18]

## DISPARITIES IN SUSCEPTIBILITY

Blumenshine et al. consider susceptibility to include underlying host factors and medical conditions that may increase the risk of disease or of complications of disease.[1] Racial/ethnic health disparities are well documented for chronic diseases, which are risk factors for H1N1 complications.[19–24] The CDC has added immunosuppression, blood disorders, and kidney disorders to the list of underlying conditions that increase susceptibility to influenza complications.[25] Blacks have the highest overall coronary heart disease mortality rate of any racial/ethnic group.[26] Obesity is a potential risk factor for

H1N1 complications. Death from obesity-related chronic diseases is significantly higher for Black women than for White women.[24] Blacks have high rates of obesity, which is associated with increased severity of asthma, again placing them at greater risk for H1N1 complications.[21,27] According to *Healthy People 2010*,

> The relative number of persons with diabetes in Black, Hispanic, and American Indian communities is one to five times greater than in white communities.[19,20]

Disparities in annual influenza immunization are contributors to unequal susceptibility and are associated with unequal access to health care. Racial/ethnic disparities in influenza vaccination exist across age groups.[22,28–32] Barriers to immunization for children include low socioeconomic status (SES), living in an urban area, and racial/ethnic minority status.[29–31] Such factors might contribute to reduced minority coverage for the H1N1 vaccine.

## DISPARITIES IN ACCESS TO HEALTH CARE

Blumenshine et al. assert that lack of access to timely care will contribute to increased morbidity and mortality from influenza. Although the CDC emphasizes early treatment with antiviral drugs,[33] timely care is less available to individuals without health insurance or a regular source of health care. According to the National Healthcare Disparities Report, among people living in the United States aged younger than 65 years in 2006, 65% of Hispanics had health insurance compared with 87.5% of non-Hispanic Whites, and 81.9% of Blacks had insurance compared with 83.3% of Whites.[34] The percentage of minorities without health insurance for the whole year was higher than was the percentage of Whites. The proportion of poor people with insurance (69.8%) was significantly lower than that of higher-income people (93.5%).[35] Twenty-five percent of low-income people reported that they did not have a usual source of health care, compared with 15% of high-income people.[36] Furthermore, more Blacks and Hispanics reported problems getting medical care as soon as they needed it than did Whites at all levels of income.[35]

Disparities have been found in the proportion of influenza patients who were prescribed antiviral drugs, even when they did have a source of health care. In the Georgia Medicaid population, a study found that after controlling for age, gender, and geography (rural/urban residence), Whites were 2.9 times more likely than were Blacks to be prescribed a drug for influenza.[37] Furthermore, linguistic, cultural, economic, and legal factors may exacerbate barriers to accessing health care among immigrants.[10,38]

On the basis of existing disparities and unequal access to health care, we predicted that racial/ethnic minority populations would bear a disproportionate burden of H1N1 influenza. Our study is the first to empirically examine racial/ethnic disparities in exposure, susceptibility to complications, and access to health care during this pandemic.

## METHODS

During the first wave of the pandemic, we surveyed a nationally representative random sample of adults about their experiences and attitudes related to swine or H1N1 influenza. We took our sample from the Knowledge Networks (KN) online research panel. The KN panel is designed to be representative of the entire US population and includes unlisted, nontelephone, and cell-phone–only households. KN uses a combination of random-digit dial and address-based probability-sampling frames covering 99% of the US population and uses probability-sampling methods to recruit panelists. To ensure participation of low-income individuals and those without Internet access, KN provides access to the Internet and hardware if needed.[39,40]

We invited a random sample of 2498 adults aged 18 years or older to participate (including oversamples of Blacks and Hispanics). A total of 1543 people completed the survey for a completion rate of 62%. The sample for this analysis consisted of the 1479 respondents who reported their race/ethnicity as White non-Hispanic, Black non-Hispanic, or Hispanic. We excluded the "Other" race/ethnicity category because its small size and heterogeneity made interpretation of the results difficult. The oversample of Hispanic respondents was drawn from the KN Knowledge Panel Latino,[41] which oversamples from geographical areas with relatively large Hispanic populations to increase the sample size of Hispanics who are "unassimilated" or self-identified Hispanic adults who are Spanish language–dominant. We further categorized Hispanic respondents by whether they chose to complete KN surveys in English or Spanish. Because of the poststratification weights, the Hispanics in the sample are demographically representative of Hispanics in the United States. However, the sample groups represented by those who chose to complete KN surveys in English or Spanish are not representative, and we included them to explore differences for further study.

KN provided a data file with weighting and stratification variables, which incorporate design-based weights to account for the recruitment of the panelists, as well as panel-based and study-specific poststratification weights benchmarked against the Current Population Survey for May 2009. All analyses reported were weighted to make them demographically representative of the US population as reported by the Current Population Survey. Study-specific poststratification weights included adjustments to account for the oversamples of Blacks and Hispanics and for nonresponse.[42]

The survey was conducted from June 3, 2009, to July 6, 2009, prior to the determination of priority groups for H1N1 vaccination later in the summer of 2009.

### Survey Instrument and Measures

The questionnaire included standard demographic variables. We developed measures of exposure to the H1N1 virus, susceptibility, and access to health care. An additional item asked about perceived discrimination in health care. The questionnaire was pilot-tested and revised, and it was translated into Spanish for Spanish language–dominant respondents.

We created 3 summative indices: (1) inability to impose social distance as a measure of exposure, (2) degree of susceptibility to the virus and its complications, and (3) degree of difficulty with access to health care. Each index was a summative score of responses to survey questions, weighting each high-risk response 1 and each low- or no-risk response 0. Thus, a higher index value indicates greater difficulty in social distancing, greater susceptibility, and less access to treatment, respectively.

The inability to impose social distance index included responses to items that asked how easy or difficult it would be for respondents to stay home from work for 7 to 10 days, that is, would they be able to work from home (or could the job be performed only at the workplace, or there was no mechanism in place to allow working from home), would they be paid for time at home, did they have sick leave at work, and did they fear the loss of their job if they did not go to work. The susceptibility index is the sum of chronic conditions from a list of conditions identified by the CDC as increasing susceptibility to complications: heart disease, high blood pressure, cancer, diabetes, asthma, lung disease (such as chronic pulmonary lung disease), and the weakening of the body's ability to fight off disease because of a health condition (i.e., immunosuppression). The access to health care index is the sum of responses indicating no health insurance, no health care provider, and the perception that lack of insurance or money would make it difficult to receive a flu shot.

### Data Analysis

We analyzed the data with Stata version 10.1 (StataCorp LP, College Station, TX) and SPSS version 17.0 (SPSS Inc, Chicago, IL) using complex survey analysis procedures.[43,44] Bivariate analysis used adjusted Pearson $\chi^2$ tests for categorical measures and adjusted Wald F tests for continuous measures. The relationship between race/ethnicity and the indicators of exposure, susceptibility, access to health care, and perceived discrimination were examined using linear regression for continuous outcomes and binary logistic regression for dichotomous outcomes. We report unadjusted models for race/ethnicity as well as models adjusted for gender, age, presence of children in the household, income, and education. A $P$ value of $<.05$ indicated a significant finding.

## RESULTS

Table 1 reports demographic characteristics by race/ethnicity. A comparison of the weighted demographic data with 2009 census data from the American Community Survey found few differences. However, we did find that the interviewed sample slightly overrepresented middle-aged (35-64 years) persons.[16]

### Disparities in Exposure

We examined the relationship of race/ethnicity with structural measures of exposure, which we hypothesized may increase exposure to the virus. Those structural measures were (1) living in a metro area (vs a nonmetro area), (2) living in a building with 2 or more apartments, (3) having a larger number of children in the household, and (4) having a larger household size (Table 2). We found that Blacks, English-speaking Hispanics, and Spanish-speaking Hispanics were more likely than were Whites to live in a metro area and to live in an apartment building ($P \leq .001$). Spanish-speaking Hispanics reported living in significantly larger households and with more children than did Whites or Blacks ($P \leq .001$).

We also examined the relationship between race/ethnicity and work-related inability to

**TABLE 1—Sample Demographics by Race/Ethnicity: Knowledge Networks Online Research Panel, United States, 2009**

| Characteristic | All (N = 1479), No. (%) or Mean (SE) | White, Non-Hispanic (n = 991), No. (%) or Mean (SE) | Black, Non-Hispanic (n = 194), No. (%) or Mean (SE) | Hispanic, Survey in English (n = 65), No. (%) or Mean (SE) | Hispanic, Survey in Spanish (n = 229), No. (%) or Mean (SE) | P[a] |
|---|---|---|---|---|---|---|
| Gender | | | | | | |
| Male | 736 (48.8) | 502 (49.1) | 89 (45.1) | 35 (50.0) | 110 (50.4) | 0.81 |
| Female | 743 (51.2) | 489 (50.9) | 105 (54.9) | 30 (50.0) | 119 (49.6) | |
| Age, y | 46.5 (0.5) | 48.3 (0.7) | 44.2 (1.3) | 46.4 (2.3) | 36.6 (0.9) | <.001 |
| 18–34 | 334 (27.9) | 180 (24.5) | 38 (31.1) | 16 (29.2) | 100 (47.9) | |
| 35–64 | 872 (57.0) | 594 (57.6) | 122 (59.3) | 37 (55.8) | 119 (50.3) | <.001 |
| ≥65 | 273 (15.1) | 217 (17.9) | 34 (9.6) | 12 (15.0) | 10 (1.8) | |
| Income | | | | | | |
| <$25 000 | 343 (25.5) | 151 (20.5) | 67 (40.6) | 10 (14.5) | 115 (49.3) | |
| $25 000–$49 999 | 399 (26.6) | 244 (24.8) | 61 (30.7) | 21 (34.8) | 73 (31.2) | <.001 |
| $50 000–$74 999 | 291 (20.0) | 220 (22.5) | 32 (13.4) | 17 (21.1) | 22 (8.8) | |
| ≥$75 000 | 446 (27.9) | 376 (32.2) | 34 (15.3) | 17 (29.5) | 19 (10.8) | |
| Education | | | | | | |
| Less than high school | 188 (14.0) | 53 (9.8) | 16 (11.0) | 10 (20.0) | 109 (45.6) | |
| High school | 416 (32.9) | 272 (32.4) | 58 (40.1) | 12 (21.7) | 74 (33.2) | <.001 |
| Some college | 455 (27.5) | 330 (28.3) | 76 (31.3) | 25 (36.7) | 24 (12.8) | |
| ≥Bachelor's degree | 420 (25.6) | 336 (29.4) | 44 (17.7) | 18 (21.5) | 22 (8.4) | |
| Children aged <18 y in household | 514 (35.6) | 274 (32.0) | 56 (31.0) | 18 (24.9) | 166 (72.9) | <.001 |
| Household size, mean (SE) | 2.9 (0.1) | 2.7 (0.1) | 2.5 (0.1) | 2.6 (0.2) | 4.6 (0.1) | <.001 |

*Note*. Numbers are unweighted; percentages and means (SE) are weighted.
[a]*P* value for difference by race/ethnicity from adjusted Pearson $\chi^2$ test for categorical data and from adjusted Wald F test for continuous measures.

**TABLE 2—Measures of Exposure to H1N1, Susceptibility to H1N1 Complications, Access to Health Care, and Perceived Discrimination, by Race/Ethnicity: Knowledge Networks Online Research Panel, United States, 2009**

| Characteristics | White, Non-Hispanic (n = 991), No. (%) or Mean (SE) | Black, Non-Hispanic (n = 194), No. (%) or Mean (SE) | Hispanic, Survey in English (n = 65), No. (%) or Mean (SE) | Hispanic, Survey in Spanish (n = 229), No. (%) or Mean (SE) | P[a] |
|---|---|---|---|---|---|
| **Measures of exposure** | | | | | |
| Structural measures | | | | | |
| Working | 558 (55.6) | 95 (50.9) | 37 (61.5) | 120 (53.7) | .58 |
| Living in a metro area | 812 (80.2) | 172 (89.5) | 62 (95.2) | 209 (91.6) | <.001 |
| Living in an apartment building | 112 (12.3) | 63 (35.8) | 16 (22.2) | 67 (29.0) | <.001 |
| Adults in household | 2.15 (0.04) | 1.90 (0.08) | 2.19 (0.10) | 2.89 (0.10) | <.001 |
| Children aged <18 y in household | 0.59 (0.04) | 0.64 (0.11) | 0.44 (0.11) | 1.72 (0.11) | <.001 |
| Work-related measures of inability to impose social distance | | | | | |
| Difficulty staying home from work for 7–10 d[b] | 403 (42.4) | 82 (48.1) | 30 (42.9) | 174 (80.7) | <.001 |
| Not able to work at home | 429 (45.8) | 62 (29.9) | 27 (43.5) | 161 (75.2) | <.001 |
| Will not get paid if stays home from work | 346 (38.3) | 55 (29.1) | 24 (36.2) | 48 (23.6) | .009 |
| Does not have sick leave at job | 237 (26.1) | 43 (23.2) | 19 (33.3) | 135 (61.4) | <.001 |
| Could lose job or business if not able to go to work | 224 (26.5) | 43 (20.9) | 15 (23.1) | 120 (57.8) | <.001 |
| Job can only be done at workplace | 423 (45.4) | 66 (34.3) | 28 (47.3) | 155 (73.1) | <.001 |
| Index of work-related inability to impose social distance | 2.26 (0.09) | 1.84 (0.17) | 2.26 (0.29) | 3.73 (0.13) | <.001 |
| Other measures of inability to impose social distance[c] | | | | | |
| Difficulty obtaining day care not with a group of children[b] | 66 (7.3) | 32 (20.0) | 5 (6.1) | 118 (53.1) | <.001 |
| Difficulty avoiding public transportation[b] | 138 (15.2) | 67 (39.7) | 19 (34.0) | 112 (50.4) | <.001 |
| **Measures of susceptibility** | | | | | |
| Heart disease | 81 (8.6) | 10 (3.6) | 3 (2.8) | 1 (0.1) | <.001 |
| High blood pressure | 314 (30.7) | 89 (47.6) | 22 (33.1) | 12 (3.2) | <.001 |
| Cancer | 89 (6.4) | 14 (3.5) | 2 (1.6) | 7 (2.8) | .03 |
| Diabetes | 108 (10.5) | 35 (13.1) | 10 (11.6) | 23 (9.7) | .79 |
| Asthma | 85 (9.3) | 21 (12.3) | 7 (9.2) | 18 (7.5) | .59 |
| Lung disease | 42 (4.2) | 7 (4.4) | 0 (0.0) | 1 (0.3) | .08 |
| Immunosuppression | 116 (11.5) | 29 (14.2) | 4 (6.2) | 24 (10.9) | .53 |
| Index of susceptibility[c] | 0.82 (0.04) | 0.99 (0.09) | 0.64 (0.12) | 0.34 (0.05) | <.001 |
| **Measures of access to health care** | | | | | |
| No regular health care provider | 113 (14.9) | 31 (20.0) | 12 (17.9) | 134 (63.2) | <.001 |
| No health insurance | 123 (16.3) | 45 (26.6) | 15 (24.9) | 154 (75.1) | <.001 |
| Lack of insurance or money makes it difficult to get flu shot | 184 (23.0) | 37 (23.3) | 16 (24.2) | 96 (43.6) | <.001 |
| Index of difficulty with access to health care[c] | 0.54 (0.04) | 0.70 (0.10) | 0.67 (0.15) | 1.83 (0.08) | <.001 |
| **Measure of discrimination** | | | | | |
| Ever experienced discrimination/hassle when seeking health care | 43 (6.2) | 50 (25.3) | 10 (14.9) | 87 (40.8) | <.001 |

*Note*. Numbers are unweighted; percentages and means (SE) are weighted. Total sample sizes may differ slightly for some items because of missing data.
[a]*P* value for difference by race/ethnicity from adjusted Pearson $\chi^2$ test for categorical data and from adjusted Wald F test for continuous measures.
[b]Percentage responding somewhat difficult or very difficult.
[c]Each index was a summative score of responses to survey questions, weighting each high-risk response 1 and each low- or no-risk response 0; thus, a higher index value indicates greater difficulty in social distancing, greater susceptibility, and less access to treatment.

impose social distance to minimize risks of exposure (Table 2). We hypothesized that not working (for any reason) would reduce work-related exposure risk. All measures included in the work-related social-distancing index were significantly associated with race/ethnicity, with Spanish-speaking Hispanics being at elevated risk on most measures ($P \leq .001$). Although significant proportions of Whites, Blacks, and English-speaking Hispanics did not have sick leave at work, a striking 61.35% of Spanish-speaking Hispanics reported not having sick leave at work ($P < .001$). In addition, 73.1% of Spanish-speaking Hispanics could only do their job in the workplace.

Directives for social distancing call upon parents to keep their children away from other children if schools or day-care centers close. Significantly, more Blacks and Spanish-speaking Hispanics reported difficulty in accessing day care for their children that was separate from other children ($P \leq .001$). Similarly, a larger proportion of each minority group reported having more difficulty in avoiding potential exposure on crowded public transportation than did Whites ($P \leq .001$).

### Disparities in Susceptibility

Susceptibility to complications arising from H1N1 infection has been found to be higher in people with underlying conditions.[25] Table 2 presents the prevalence of diseases by race/ethnicity, confirming frequent findings in the literature concerning both the prevalence and the patterns of chronic disease differences by race. Although the prevalence of disease in some groups is small, leading to wider margins of error, on the basis of our susceptibility index we found that Blacks had the highest overall susceptibility, followed by Whites and English-speaking Hispanics, with Spanish-speaking Hispanics the least likely to have underlying disease-based susceptibility. This finding may be explained in part by a younger mean age among Hispanic respondents.

The model of Blumenshine et al. considers prior vaccination history within the construct of susceptibility.[1] Prior influenza vaccination history has been found to strongly predict willingness to accept H1N1 vaccine the next fall.[45,46] We found that Blacks (39%) and Hispanics (37.3%) were significantly less likely than were Whites (44.6%) to receive influenza vaccine regularly ($P = .02$).

### Disparities in Access to Health Care

Access to timely health care is paramount during a pandemic.[1] We found that race/ethnicity were significantly associated with access to health care (Table 2): 63.2% of Spanish-speaking Hispanics lacked a regular health care provider, which was significantly different from Blacks, English-speaking Hispanics, and Whites ($P < .001$). Moreover, 75.1% of Spanish-speaking Hispanics lacked health insurance. Finally, 43.6% of Spanish-speaking Hispanics responded that lack of money or insurance would make it difficult for them to get a flu shot, compared with 23% of Whites, 23.3% of Blacks, and 24.2% of English-speaking Hispanics ($P \leq .001$).

We also examined whether people had faced racial/ethnic discrimination when accessing health care in the past; we hypothesized that this experience could impair their ability or readiness to access health care in a timely fashion in the present or future. We found that race/ethnicity was significantly associated with reports of discrimination ($P \leq .001$).

### Contribution of Socioeconomic Factors to Racial/Ethnic Disparities

We used regression analyses to determine the proportion of racial/ethnic disparities reported above that could be explained by differences in income and education, as well as demographic factors such as age, gender, and presence of children in the household (Tables 3 and 4). Both unadjusted regression models and models adjusted for potentially confounding variables are reported. No interaction effects are investigated here because the main effects of race/ethnicity are the focus of this analysis. We performed listwise deletion of missing data in the regressions; thus, the number of cases reported varies for each regression because of variations in missing data.

### Exposure

We examined measures of exposure in linear regression models, including the number of adults in a household, the number of children aged younger than 18 years in a household, and the index of work-related inability to impose social distance (Table 3). The unadjusted models mirror the bivariate results. In adjusted models controlling for the confounding variables of age, gender, presence of children in the household, income, and education, Spanish-speaking Hispanics were at potentially higher risk of exposure because of larger household size, more children in the household, and the least ability to distance from others at work ($P < .001$). In addition, Blacks reported significantly smaller household sizes than did Whites and greater ability to impose social distance at work, suggesting reduced risk of potential exposure for these indicators.

We carried out logistic regression analyses with 4 binary response measures of exposure as dependent variables (Table 4). We found that, compared with Whites, Blacks were 2.4 times more likely, English-speaking Hispanics 5.1 times more likely, and Spanish-speaking Hispanics 3 times more likely to live in a metro area, after controlling for demographic factors and SES. All 3 minority groups were significantly more likely to live in an apartment building than were Whites, and all 3 groups were more likely to have more difficulty avoiding public transportation than were Whites after controlling for demographic factors and SES. Finally, after controlling for demographic factors and SES, Blacks were 3 times more likely than were Whites and Spanish-speaking Hispanics were 10.3 times more likely than were Whites to have difficulty accessing day care for their children that was separate from other children ($P < .001$).

### Susceptibility

After controlling for confounding demographic and socioeconomic factors, Spanish-speaking Hispanics remained significantly less susceptible than did Whites to complications from H1N1 infection as measured by the susceptibility index ($B = -0.37$; $P < .001$). After controlling for SES and demographics, Blacks did not demonstrate significantly greater susceptibility, and English-speaking Hispanics were also not significantly different from Whites in their susceptibility to complications from H1N1 infection (Table 3).

### Access to Health Care

We used a linear regression to examine access to health care, as measured by the access to health care index (Table 3). After controlling for demographics and SES, Spanish-speaking Hispanics had significantly greater difficulty accessing health care than did Whites ($B = 0.85$, $P < .001$). In logistic regression, we found that even after controlling for demographics and SES all 3 minority groups were much more likely to report having been discriminated against when accessing health care than were Whites (Table 4).

## DISCUSSION

Our study adds empirical data to the mounting evidence that racial/ethnic minorities are at elevated risk during the H1N1 pandemic. Existing health disparities may increase the likelihood of severe clinical complications

**TABLE 3—Multiple Linear Regression of Race/Ethnicity as a Predictor of Indicators of H1N1 Exposure, Susceptibility to H1N1 Complications, and Access to Health Care: Knowledge Networks Online Research Panel, United States, 2009**

| Characteristics | No.[b] | Unadjusted Model: Unstandardized Regression Coefficient (SE) | Unadjusted Model: P>t | Unadjusted Model: $R^2$ | Adjusted Model[a]: Unstandardized Regression Coefficient (SE) | Adjusted Model[a]: P>t | Adjusted Model[a]: $R^2$ |
|---|---|---|---|---|---|---|---|
| **Measures of exposure** | | | | | | | |
| Adults in household | | | | | | | |
| White, non-Hispanic (Ref) | 963 | 1.0 | | 0.06 | 1.0 | | 0.21 |
| Black, non-Hispanic | 183 | –0.25 (0.09) | .01 | | –0.22 (0.09) | .01 | |
| Hispanic, survey in English | 65 | 0.04 (0.11) | .69 | | –0.0001 (0.10) | .99 | |
| Hispanic, survey in Spanish | 219 | 0.75 (0.11) | <.001 | | 0.55 (0.13) | <.001 | |
| Children aged <18 y in household | | | | | | | |
| White, non-Hispanic (Ref) | 963 | 1.0 | | 0.09 | 1.0 | | 0.70 |
| Black, non-Hispanic | 183 | 0.05 (0.12) | .67 | | 0.07 (0.07) | .32 | |
| Hispanic, survey in English | 65 | –0.14 (0.12) | .23 | | –0.01 (0.05) | .78 | |
| Hispanic, survey in Spanish | 219 | 1.13 (0.12) | <.001 | | 0.33 (0.09) | <.001 | |
| Index of work-related inability to impose social distance[c] | | | | | | | |
| White, non-Hispanic (Ref) | 963 | 1.0 | | 0.05 | 1.0 | | 0.15 |
| Black, non-Hispanic | 183 | –0.42 (0.19) | .03 | | –0.57 (0.20) | .01 | |
| Hispanic, survey in English | 65 | 0.001(0.30) | .99 | | –0.11 (0.30) | .72 | |
| Hispanic, survey in Spanish | 219 | 1.46 (0.16) | <.001 | | 0.89 (0.20) | <.001 | |
| **Measures of susceptibility** | | | | | | | |
| Index of susceptibility[c] | | | | | | | |
| White, non-Hispanic (Ref) | 981 | 1.0 | | 0.02 | 1.0 | | 0.19 |
| Black, non-Hispanic | 194 | 0.17 (0.10) | .10 | | 0.16 (0.10) | .12 | |
| Hispanic, survey in English | 65 | –0.18 (0.13) | .16 | | –0.15 (0.12) | .21 | |
| Hispanic, survey in Spanish | 226 | –0.47 (0.07) | <.001 | | –0.37 (0.09) | <.001 | |
| **Measures of access to health care** | | | | | | | |
| Index of difficulty with access to health care[c] | | | | | | | |
| White, non-Hispanic (Ref) | 980 | 1.0 | | 0.14 | 1.0 | | 0.27 |
| Black, non-Hispanic | 189 | 0.16 (0.10) | .13 | | –0.03 (0.10) | .74 | |
| Hispanic, survey in English | 65 | 0.12 (0.16) | .43 | | 0.06 (0.14) | .68 | |
| Hispanic, survey in Spanish | 225 | 1.28 (0.09) | <.001 | | 0.85 (0.11) | <.001 | |

[a]Adjusted for the confounders of gender, age, presence of children in the household, income, and education. Presence of children was excluded from regression with number of children aged younger than 18 years in household as outcome.
[b]The number of cases varies because of missing data.
[c]Each index was a summative score of responses to survey questions, weighting each high-risk response 1 and each low- or no-risk response 0; thus, a higher index value indicates greater difficulty in social distancing, greater susceptibility, and less access to treatment.

following H1N1 infection. Recent reports have discussed differential exposure or susceptibility as potential sources of racial/ethnic disparities in H1N1 hospitalization rates,[3,8] and our study confirms the existence of significant racial/ethnic disparities in potential exposure risk, susceptibility to complications, and access to health care. If our results can be generalized to the US population, these would be cause for urgent action.

Others have made the compelling case that existing disparities could worsen a pandemic, but our study provides empirical evidence for the conceptual model of Blumenshine et al. in the context of a real pandemic,[1] and it provides necessary insights into considerations for planning countermeasures and mitigation strategies. We are deeply concerned that the additive effects of higher exposure, susceptibility to severe disease, and less ability to access health care place racial/ethnic minority populations at greater risk from H1N1 infection and its complications.

Discussions about policies for social distancing fail to account for the reality of differential exposure in a society in which race/ethnicity already contributes to health disparities. Our study confirms the existence of racial/ethnic disparities in ability to impose social distance, just as Blendon et al. found in the context of a hypothetical pandemic.[15] Of particular concern is the fact that school closures may have a disproportionate impact on minority families who are unable to work at home or who do not have child care that limits exposure to other (potentially infected) children. School closings may be particularly difficult for single

**TABLE 4—Logistic Regression of Race/Ethnicity as a Predictor of Indicators of H1N1 Exposure and Discrimination: Knowledge Networks Online Research Panel, United States, 2009**

| Characteristics | No.[b] | Unadjusted Model | | | Adjusted Model[a] | | |
|---|---|---|---|---|---|---|---|
| | | Odds Ratio (95% CI) | *P*>t | Pseudo-$R^{2c}$ | Odds Ratio (95% CI) | *P*>t | Pseudo-$R^{2c}$ |
| **Measures of exposure** | | | | | | | |
| Living in a metro area | | | | | | | |
| White, non-Hispanic (Ref) | 991 | 1.0 | | 0.03 | 1.0 | | 0.07 |
| Black, non-Hispanic | 194 | 2.1 (1.2, 3.8) | .01 | | 2.4 (1.3, 4.3) | .004 | |
| Hispanic, survey in English | 65 | 4.9 (1.3, 17.7) | .02 | | 5.1 (1.4, 18.7) | .02 | |
| Hispanic, survey in Spanish | 229 | 2.7 (1.6, 4.6) | <.001 | | 3.9 (2.1, 7.1) | <.001 | |
| Living in an apartment | | | | | | | |
| White, non-Hispanic (Ref) | 991 | 1.0 | | 0.08 | 1.0 | | 0.17 |
| Black, non-Hispanic | 194 | 4.0 (2.6, 6.2) | <.001 | | 3.1 (1.9, 5.1) | <.001 | |
| Hispanic, survey in English | 65 | 2.0 (1.0, 4.1) | .05 | | 2.1 (1.0, 4.4) | .05 | |
| Hispanic, survey in Spanish | 229 | 2.9 (1.9, 4.4) | <.001 | | 3.2 (1.8, 5.7) | <.001 | |
| Difficulty obtaining day care not with a group of children | | | | | | | |
| White, non-Hispanic (Ref) | 987 | 1.0 | | 0.21 | 1.0 | | 0.60 |
| Black, non-Hispanic | 194 | 3.2 (1.8, 5.7) | <.001 | | 3.0 (1.6, 5.6) | <.001 | |
| Hispanic, survey in English | 65 | 0.8 (0.2, 2.9) | .76 | | 0.8 (0.2, 2.5) | .68 | |
| Hispanic, survey in Spanish | 224 | 14.5 (9.2, 22.7) | <.001 | | 10.3 (5.9, 18.2) | <.001 | |
| Difficulty avoiding public transportation | | | | | | | |
| White, non-Hispanic (Ref) | 978 | 1.0 | | 0.12 | 1.0 | | 0.15 |
| Black, non-Hispanic | 193 | 3.7 (2.4, 5.7) | <.001 | | 3.0 (1.9, 4.6) | <.001 | |
| Hispanic, survey in English | 65 | 2.9 (1.5, 5.5) | .002 | | 2.8 (1.5, 5.3) | .001 | |
| Hispanic, survey in Spanish | 222 | 5.6 (3.9, 8.3) | <.001 | | 4.0 (2.5, 6.5) | <.001 | |
| **Measures of discrimination** | | | | | | | |
| Ever experienced discrimination/hassle when seeking health care | | | | | | | |
| White, non-Hispanic (Ref) | 984 | 1.0 | | 0.18 | 1.0 | | 0.24 |
| Black, non-Hispanic | 193 | 5.2 (3.0, 9.0) | <.001 | | 3.9 (2.2, 7.0) | <.001 | |
| Hispanic, survey in English | 84 | 2.7 (1.1, 6.4) | .03 | | 2.8 (1.2, 6.9) | .02 | |
| Hispanic, survey in Spanish | 227 | 10.5 (6.4, 17.2) | <.001 | | 6.1 (3.2, 11.5) | <.001 | |

*Note.* CI = confidence interval.
[a]Adjusted for the confounders of gender, age, presence of children in the household, income, and education.
[b]The number of cases varies because of missing data.
[c]Nagelkerke $R^2$.

mothers and women in the workforce; thus, the impact of gender on the ability to impose social distance should be a subject of future research.

Disparities in susceptibility to complications from H1N1 were measured by self-reports of chronic conditions and immunosuppression. We are aware that our data do not correlate prevalence of chronic diseases with actual incidence of either H1N1 infection or complications. However, CDC data suggest that patients suffering from chronic diseases have increased susceptibility to complications from H1N1.[25,47] In our survey, Blacks were highest on the susceptibility index, followed by Whites and then Hispanics. Spanish-speaking Hispanics were lowest on the susceptibility index, presumably because of their younger age. However, if we were successful in removing the effects of SES and other demographics, race/ethnicity alone does not seem to explain the susceptibility to complications. Still, we believe there is an urgent need for targeted, culturally appropriate communication that elucidates elevated risk from existing diseases. The CDC, health departments, and professional organizations such as the American Medical Association and the American Academy of Pediatrics all must clearly communicate this information to health care providers who serve minority patients.

Significant differences in access to health care and with greater perceived discrimination in health care place Blacks and Spanish-speaking Hispanics at greater risk of receiving later—and perhaps poorer—health care. This finding is particularly troublesome because the pandemic is colliding with severe budget crises that hamper the availability and delivery of health care. Additionally, the highly politicized furor against treating undocumented immigrants is a major point of contention in the current health care reform debate. These

dynamics, along with fear of deportation by immigration and naturalization authorities targeting health clinics, may result in fewer Hispanics seeking timely care for H1N1, particularly those who are Spanish speakers. As a population, Hispanics are younger, have more women of childbearing age, and experience disparities in health conditions, further exacerbating the potential for disproportionate morbidity and mortality. Because our study occurred prior to vaccine availability and the designation of priority groups, we did not explore any possible interaction between race/ethnicity and one's ability to access the vaccine.

Although the issue of mistrust is beyond the scope of this study, the literature confirms that this factor may influence willingness to accept a vaccine, even when it is available.[22,46,48–50] In our study, we found significant differences in experiences with discrimination in the health care setting, which could contribute to mistrust. There is already evidence of lower uptake of H1N1 vaccine among minorities.[51] Clearly, future research should examine the extent to which trust plays a role in H1N1 vaccine acceptance and the extent to which minorities seek the H1N1 vaccine.

To address the factors affecting racial/ethnic disparities in the H1N1 pandemic, we offer these recommendations:

- The CDC and health departments must include race/ethnicity in reporting on H1N1 hospitalizations and deaths. These data will facilitate deliberate communication strategies for minority populations, which could encourage minorities to perceive their own susceptibility and to take timely action for prevention and to seek care.
- Targeted, culturally appropriate risk communication, using trusted spokespersons and channels, is critically important.[49,50] That communication must focus on underlying conditions and other factors (e.g., young age, pregnancy) that place racial/ethnic minorities at greater risk for complications following H1N1 infection.
- Engaging both national and local organizations that represent minority populations is necessary to get the message to at-risk groups.[22,49,50]
- Continuous communication to and education of health care providers is critical to ensure that they recognize higher-risk individuals and aggressively deliver adequate care to them.
- Although the identification of priority groups for initial vaccine allocations is essential, minority groups may misinterpret that policy as exclusionary, which could contribute to mistrust. Engaging minority organizations in communication about the rationale for priority groups could enhance understanding and prevent mistrust.
- Local and state health departments, federally qualified health centers, and other health care providers must partner now with community-based organizations that serve at-risk populations.[49] This step is particularly essential for undocumented immigrants, who must be encouraged to seek care without risk of detention or deportation.
- Policymakers must ensure that undocumented immigration status does not present a barrier to the health care of immigrants, which would place them, their families, and the broader public at increased risk for H1N1 infection.
- The US Congress and states must move to pass paid sick-leave legislation that enables low-income and private-sector workers to adhere to social-distancing recommendations even when they lack paid sick leave.

Most H1N1 pandemic planning and response has not recognized the extent to which racial/ethnic health disparities have placed segments of our population at risk for increased morbidity and mortality. Although it may not be easy to change some of the factors that drive exposure and susceptibility, we can act with urgency and ensure that those experiencing disparities know their level of risk, and we can help them to trust that they will receive timely care from health care providers. ■

## About the Authors

*Sandra Crouse Quinn is with the Department of Family Science, School of Public Health, University of Maryland, College Park. Supriya Kumar is with the Department of Environmental and Occupational Health, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, PA. Vicki S. Freimuth is with the Department of Speech Communication, Franklin College of Arts and Sciences, and the Grady College of Journalism and Mass Communication, University of Georgia, Athens. Donald Musa is with the University Center for Social and Urban Research, University of Pittsburgh, Pittsburgh. Nestor Casteneda-Angarita is with the Department of Political Science, University of Pittsburgh, Pittsburgh. Kelley Kidwell is with the Department of Biostatistics, Graduate School of Public Health, University of Pittsburgh, Pittsburgh.*

*Correspondence should be sent to Sandra Crouse Quinn, Department of Family Science, School of Public Health, University of Maryland, 2242CC SPH Building #255, College Park, MD 20742-2611 (e-mail: scquinn@umd.edu). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints/Eprints" button.*

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## Contributors

S.C. Quinn and V.S. Freimuth obtained all funding for the study. S.C. Quinn, S. Kumar, and V.S. Freimuth designed and conducted the study and led the analyses. S.C. Quinn and S. Kumar led the writing of the article. K. Kidwell did the initial data cleaning and preliminary analyses. N. Casteneda-Angarita and D. Musa conducted all further statistical analyses and participated in the preparation of the methods section and tables. All authors contributed to article preparation, reviewed article drafts, and approved the final article.

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The institutional review boards of the University of Pittsburgh (PRO09050129) and the University of Georgia (2009-10874-0) approved this study protocol.

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