

Awareness, Attitudes, and Actions Related to COVID-19 Among Adults With Chronic Conditions at the Onset of the U.S. Outbreak

A Cross-sectional Survey

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Background: The evolving outbreak of coronavirus disease 2019 (COVID-19) is requiring social distancing and other measures to protect public health. However, messaging has been inconsistent and unclear.

Objective: To determine COVID-19 awareness, knowledge, attitudes, and related behaviors among U.S. adults who are more vulnerable to complications of infection because of age and comorbid conditions.

Design: Cross-sectional survey linked to 3 active clinical trials and 1 cohort study.

Setting: 5 academic internal medicine practices and 2 federally qualified health centers.

Patients: 630 adults aged 23 to 88 years living with 1 or more chronic conditions.

Measurements: Self-reported knowledge, attitudes, and behaviors related to COVID-19.

Results: A fourth (24.6%) of participants were "very worried" about getting the coronavirus. Nearly a third could not correctly identify symptoms (28.3%) or ways to prevent infection (30.2%). One in 4 adults (24.6%) believed that they were "not at all likely"

to get the virus, and 21.9% reported that COVID-19 had little or no effect on their daily routine. One in 10 respondents was very confident that the federal government could prevent a nationwide outbreak. In multivariable analyses, participants who were black, were living below the poverty level, and had low health literacy were more likely to be less worried about COVID-19, to not believe that they would become infected, and to feel less prepared for an outbreak. Those with low health literacy had greater confidence in the federal government response.

Limitation: Cross-sectional study of adults with underlying health conditions in 1 city during the initial week of the COVID-19 U.S. outbreak.

Conclusion: Many adults with comorbid conditions lacked critical knowledge about COVID-19 and, despite concern, were not changing routines or plans. Noted disparities suggest that greater public health efforts may be needed to mobilize the most vulnerable communities.

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The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and resultant coronavirus disease 2019 (COVID-19) have evolved into a pandemic, requiring persons around the world to attend to rapidly changing messages about public health and take immediate actions to minimize their risk for infection and the spread of the virus (1). This unprecedented global crisis has also been marked by miscommunication regarding the imminent threat of COVID-19, leading to public confusion and inaction (2).

Older adults and those with underlying health conditions are at greatest risk for severe infection and death due to COVID-19 (3). The same factors that make individuals more vulnerable are also associated with reduced ability to access and understand health information, make well-informed decisions, and take optimal health-promoting actions—a skill set commonly called "health literacy" (4, 5). This is especially true when the health information itself is not timely, trusted, consistent, or actionable. Health literacy has emerged over the past 3 decades as one of the strongest psychosocial determinants of health, and it has also been shown to explain a range of health disparities by age, race/ethnicity, and socioeconomic status (6). Thus, in uncertain times like this, when the interpretation of critical

and ever-changing public health messages is paramount, many vulnerable populations may be further marginalized by inadequate health communication, posing substantial risks to themselves and their communities.

We did a time-sensitive study among higher-risk, older adults living with 1 or more chronic conditions to determine their current awareness of COVID-19, their perception of the seriousness of its threat, their level of worry and concern related to contracting the virus, whether it is affecting their daily routine or existing plans, how prepared they feel to handle an outbreak, and their confidence in the federal government response. This took place from 13 through 20 March 2020 during the initial outbreak of the virus in the United States. We focused on the role of health literacy and other psychosocial health determinants in understanding risks for COVID-19 and the initiation of preventive behaviors.

METHODS

The Chicago COVID-19 Comorbidities (C3) Survey is a cross-sectional telephone survey of active participants in 1 of 4 ongoing projects that are researching

Table 1. Eligible Sample and Associated NIH Parent Studies in the C3 Survey*

| Parent Study (NIH Project Number) | Design | Study Characteristics | | | | | |
|--|----------------|-----------------------|---------------------|------------------------|-------------------------------|---------------------------------------|--|
| | | Age, y | Language | C3 Sample (n = 630), n | Eligible Sample (N = 1211), N | Clinical | Setting |
| Health Literacy and Cognitive Function Among Older Adults (R01AG030611) | Cohort | 65-85 | English | 153 | 255 | None | 1 academic internal medicine clinic, 5 FQHCs |
| A Universal Medication Schedule to Promote Adherence to Complex Drug Regimens (R01AG046352) | Clinical trial | ≥50 | English and Spanish | 215 | 459 | Taking ≥5 long-term medications | 1 academic internal medicine clinic, 1 FQHC |
| Transplant Regimen Adherence for Kidney Recipients by Engaging Information Technologies: The TAKE IT Trial (R01DK110172) | Clinical trial | ≥21 | English | 126 | 200 | Kidney transplant | 1 transplant center |
| EHR-Based Universal Medication Schedule to Improve Adherence to Complex Regimens (R01NR015444) | Clinical trial | ≥21 | English | 136 | 297 | T2DM, taking ≥5 long-term medications | 5 academic internal medicine clinics |

C3 = Chicago COVID-19 Comorbidities; COVID-19 = coronavirus disease 2019; EHR = electronic health record; FQHC = federally qualified health center; NIH = National Institutes of Health; T2DM = type 2 diabetes mellitus.

* Only a subset of eligible participants (733 of 1211) were contacted during the 1-wk survey period.

health services, are sponsored by the National Institutes of Health, and are taking place among 7 primary care sites (5 academic internal medicine clinics and 2 federally qualified health centers) across the greater Chicago area (Table 1).

Health Literacy and Cognitive Function Among Older Adults (R01AG030611) is a cohort study examining cognitive and psychosocial factors associated with self-management and outcomes of chronic disease over time among predominantly older adults. Three randomized controlled trials—EHR-Based Universal Medication Schedule to Improve Adherence to Complex Regimens (R01NR015444), A Universal Medication Schedule to Promote Adherence to Complex Drug Regimens (R01AG046352), and Transplant Regimen Adherence for Kidney Recipients by Engaging Information Technologies: The TAKE IT Trial (R01DK110172)—evaluate health system strategies that leverage electronic health records and available consumer technologies to improve patient adherence and safe use of complex drug regimens. These studies were selected because they enroll mostly middle-aged or older adults (range, 23 to 88 years) with 1 or more chronic conditions who therefore would be at greater risk for COVID-19. The studies use common assessments, allowing for uniform measurement of many patient characteristics. The Northwestern University Institutional Review Board approved study procedures, and all patients included in this telephone survey had provided prior consent to be contacted for future research opportunities. Data were collected from 13 through 20 March 2020.

Sample

Inclusion criteria varied across studies by age, presence of specific chronic conditions, having been prescribed complex regimens (≥5 medications), and being an active patient at specified primary care sites; Table 1 provides study-specific eligibility criteria. Methods of these studies have also been described in prior publi-

cations (7-9). In brief, recruitment procedures included identifying potentially eligible participants via electronic health record queries; sending them a letter describing the study; then telephoning any patients who did not opt out of being contacted to introduce the study, screen for eligibility, and schedule an in-person baseline interview. Common exclusion criteria for all studies include the presence of a severe and uncorrectable cognitive, visual, or hearing impairment that would preclude a participant's ability to complete interviews. For this survey, we targeted participants whose last interview was done between 2018 and the present. This time frame was selected to ensure that previously collected data from each parent study—which were merged with data from this survey—were most current; participants with the most recently collected prior data were prioritized for recruitment.

Procedure

Trained research interviewers contacted participants outside their normally scheduled research interviews to invite them to answer a short set of questions pertaining to COVID-19 by telephone. Participant responses were recorded by interviewers using REDCap web-based survey software. On average, surveys took less than 10 minutes, and participants who completed the survey were told that they would be mailed a \$10 gift certificate for their time. In total, 2010 adults were enrolled in the parent studies and were eligible for the survey; 733 were contacted during the week under investigation. Of these, 27 declined participation and 76 could not be reached or asked to be contacted at a later date. In all, 630 completed the study, for an overall cooperation rate of 85.9%.

Measurement

Across all 4 studies, there was prior, uniform collection of patient demographics (age, sex, race, and ethnicity), socioeconomic status (household income, num-

Table 2. Knowledge, Attitudes, and Self-reported Behaviors Toward COVID-19 in Overall Sample*

| Item | Summary Value |
|---|---------------|
| COVID-19 awareness and concern | |
| Mean response (SD) to: "On a scale of 1 to 10, how serious of a public health threat do you think the coronavirus is or might become? (1 being no threat at all, 10 being a very serious public health threat)" | 9.0 (1.7) |
| How worried are you about getting the coronavirus? | |
| Very worried | 24.6 |
| Somewhat worried | 39.1 |
| A little worried | 23.4 |
| Not worried at all | 12.9 |
| How worried are you about getting the flu? | |
| Very worried | 10.8 |
| Somewhat worried | 26.8 |
| A little worried | 26.5 |
| Not worried at all | 35.9 |
| Did you get a flu shot this past year? | |
| Yes | 79.5 |
| No | 20.3 |
| I don't know | 0.2 |
| Do you think that you will get sick from the coronavirus? | |
| I definitely will | 1.3 |
| I probably will | 8.2 |
| It's possible | 65.9 |
| Not at all | 24.6 |
| How likely do you think it is that you or someone you know may get sick from the coronavirus this year? | |
| Very likely | 20.3 |
| Somewhat likely | 45.4 |
| Not that likely | 23.6 |
| Not at all likely | 10.7 |
| COVID-19 knowledge | |
| Mean response (SD) to: "What percentage of people who get the coronavirus do you think will die as a result?"† | 14.2 (19.2) |
| Mean response (SD) to: "What percentage of people who get the coronavirus do you think will have only mild symptoms?"‡ | 53.6 (27.1) |
| Correctly identified 3 symptoms of the coronavirus | |
| Yes | 71.7 |
| No | 28.3 |
| Correctly identified 3 prevention methods of the coronavirus | |
| Yes | 69.8 |
| No | 30.2 |
| Related behaviors | |
| How much has the coronavirus changed your daily routine? | |
| A lot | 58.6 |
| Some | 19.5 |
| A little | 14.6 |
| Not at all | 7.3 |
| Are you changing any plans that you have made because of the coronavirus? | |
| Yes | 78.1 |
| No | 21.9 |
| I don't know | 0.0 |
| Preparedness | |
| How confident are you that the federal government can prevent a nationwide outbreak of the coronavirus? | |
| Very confident | 10.2 |
| Somewhat confident | 34.1 |
| Not very confident | 26.6 |
| Not confident at all | 29.1 |
| How prepared do you think you are if there were to be a widespread coronavirus outbreak? | |
| Very prepared | 20.8 |
| Somewhat prepared | 50.1 |
| A little prepared | 22.3 |
| Not prepared at all | 6.8 |

COVID-19 = coronavirus disease 2019.

* Values are percentages unless otherwise stated.

† 42 participants did not respond to this item.

‡ 31 participants did not respond to this item.

Table 3. Sample Characteristics (n = 630)

| Variable | Summary Value* |
|-----------------------------------|----------------|
| Mean age (SD), y | 62.1 (11.3) |
| Age group | |
| <60 y | 37.3 |
| 60–69 y | 35.7 |
| ≥70 y | 27.0 |
| Female sex | 59.7 |
| Race† | |
| Black | 32.3 |
| White | 62.1 |
| Other | 5.6 |
| Hispanic | 21.5 |
| Limited English proficiency | 11.3 |
| Living below poverty level‡ | 29.4 |
| Married§ | 40.0 |
| Health insurance | |
| Medicare | 16.5 |
| Medicaid | 12.6 |
| Private | 24.6 |
| Medicare and private | 28.4 |
| Medicare and Medicaid | 17.9 |
| Self-pay/none | |
| Primary care setting | |
| Academic | 67.9 |
| Federally qualified health center | 32.1 |
| Employment status | |
| Working for pay | 40.6 |
| Not working (retired/unemployed) | 59.4 |
| Health literacy | |
| Low | 24.3 |
| Marginal | 24.0 |
| Adequate | 51.7 |
| Low health activation | 47.9 |
| Number of chronic conditions | |
| 1 | 14.3 |
| 2 | 19.2 |
| ≥3 | 66.5 |
| Heart disease | 23.4 |
| Pulmonary disease | 24.6 |
| Diabetes (type 1 or 2) | 54.4 |
| Hypertension | 75.2 |
| Organ transplant recipient | 20.0 |
| Self-reported overall health | |
| Excellent | 8.4 |
| Very good | 28.7 |
| Good | 41.1 |
| Fair | 18.1 |
| Poor | 3.7 |

* Values are percentages unless otherwise stated.

† Missing data for 23 participants.

‡ Missing data for 3 participants.

§ Missing data for 55 participants.

ber in household, educational attainment, employment status, and health insurance), and self-reported chronic conditions. All included the Newest Vital Sign to assess health literacy (10). The Consumer Health Activation Index was used to determine patient activation across studies (11). In addition, a single item was used to capture self-reported overall health (excellent, very good, good, fair, or poor). For R01AG046352, both English- and Spanish-speaking patients participated; limited English proficiency (LEP) was determined by patients self-reporting how well they spoke English.

COVID-19 Awareness and Concern

Survey items were adapted from questionnaires used to study prior outbreaks (12). Awareness of COVID-19 was assessed using 3 items that asked whether participants had heard of the novel coronavirus, if they had been told they had it or believed they did, or if someone they knew had been told they had it or believed they did (Table 2 lists the items). Perceived concern for COVID-19 (more plainly called “coronavirus”) was evaluated by first asking participants to rate, on a scale of 1 to 10 (1 being no threat at all and 10 being very serious), how serious a public health threat they believed the coronavirus is or might become. In addition, a single question asked participants to rate their level of worry about getting the coronavirus (very worried, somewhat worried, a little worried, or not worried at all). To provide context, this same question was asked with regard to influenza, and participants were also asked whether they had received an influenza vaccine in the past year.

COVID-19 Knowledge

Demonstrated knowledge of COVID-19 was assessed through open-ended questions asking participants to name 3 symptoms of the coronavirus and 3 actions they could take to avoid becoming infected. Five trained expert clinician raters (M.S., J.A.L., T.R., D.L., and M.A.) documented and independently coded verbatim responses, which were then thematically analyzed by members of the research team. In addition, participants were asked to estimate the percentage of persons who acquire the coronavirus who will die of it and the percentage who will have only mild symptoms.

Related Behaviors

Participants were asked whether they were currently making changes to their daily routines as a result of the coronavirus and whether they had changed any of their plans. Verbatim responses were documented for participants stating that they had changed plans, and responses were also independently coded by 2 trained raters and then thematically analyzed.

Respondents were asked about the likelihood of themselves or someone they know getting the coronavirus (very likely, somewhat likely, not that likely, or not at all likely). They also answered questions about their sources for information about the coronavirus, confidence that the federal government could prevent a national outbreak (very confident, somewhat confident, not very confident, or not confident at all), and perceived preparedness if a widespread outbreak were to occur (very prepared, somewhat prepared, a little prepared, or not prepared at all).

Statistical Analysis

Descriptive statistics (means with SDs and percentage frequencies) were calculated for all patient characteristics and survey responses. Associations between patient characteristics and responses to COVID-19 awareness, perceived concern, knowledge, and related

behavior items were then examined in bivariate analyses using χ^2 tests, *t* tests, or analysis of variance, as appropriate. Multivariable linear regression models were used to estimate least-squares means (with 95% CIs) for the continuous outcome of perceived concern. For dichotomous outcomes, a multivariable Poisson distribution was used rather than odds ratios for the relative risk estimates (13). All models included health literacy as a primary covariate of interest, additional variables affecting knowledge and behavior (age, gen-

der, race, and income), day the survey was done, and parent study. Statistical analyses were performed using Stata/SE, version 15 (StataCorp).

Role of the Funding Source

The study was supported by National Institutes of Health projects. The funding sources had no role in the design, conduct, or analysis of the study or the decision to submit the manuscript for publication.

Table 4. Knowledge, Attitudes, and Self-reported Behaviors Toward COVID-19 Across Sample Characteristics (*n* = 630)*

| Variable | Awareness and Concern | | | Knowledge | | Reported Behavior | | Preparedness | |
|-------------------------------------|---|----------------|---------------------------|--------------|---------------|--------------------------|------------------|-----------------------------|-----------------|
| | Mean Seriousness of Threat on 1-10 Scale (SD) | Not Worried, % | Not Likely to Get Sick, % | Symptoms, % | Prevention, % | Changed Daily Routine, % | Changed Plans, % | Confidence in Government, % | Not Prepared, % |
| Age group | | | | | | | | | |
| <60 y | 8.7 (1.7)† | 33.1 | 23.7 | 76.6† | 71.5‡ | 54.5 | 77.9 | 46.0 | 28.9 |
| 60-69 y | 8.9 (1.9)† | 41.4 | 24.4 | 74.2† | 73.8‡ | 62.2 | 77.8 | 45.7 | 30.8 |
| ≥70 y | 9.3 (1.4)† | 34.3 | 26.1 | 61.8† | 62.4‡ | 59.4 | 78.8 | 40.2 | 27.1 |
| Sex | | | | | | | | | |
| Female | 9.2 (1.5)§ | 38.4 | 27.9‡ | 72.3 | 70.5 | 58.2 | 81.4‡ | 45.2 | 30.3 |
| Male | 8.6 (1.9)§ | 33.2 | 19.7‡ | 70.9 | 68.9 | 59.1 | 73.2‡ | 43.1 | 27.3 |
| Race | | | | | | | | | |
| Black | 9.0 (1.8) | 45.9† | 36.1§ | 62.2§ | 68.9 | 49.5† | 72.5 | 42.6 | 39.8§ |
| White | 8.9 (1.7) | 32.0† | 17.5§ | 78.3§ | 70.8 | 62.9† | 80.4 | 44.5 | 22.9§ |
| Other | 9.2 (1.6) | 35.3† | 29.4§ | 50.0§ | 73.5 | 58.8† | 85.3 | 52.9 | 23.5§ |
| Hispanic | | | | | | | | | |
| Yes | 8.9 (1.8) | 32.1 | 32.8‡ | 71.9 | 79.3† | 55.6 | 77.8 | 57.8§ | 40.7§ |
| No | 9.0 (1.7) | 37.5 | 22.3‡ | 71.7 | 67.2† | 59.5 | 78.3 | 40.5§ | 25.8§ |
| LEP | | | | | | | | | |
| Yes | 8.9 (1.8) | 35.2 | 35.2‡ | 81.7‡ | 84.5† | 45.1‡ | 74.7 | 66.2§ | 43.7† |
| No | 9.0 (1.7) | 36.5 | 23.2‡ | 70.5‡ | 68.0† | 60.3‡ | 78.5 | 41.6§ | 27.2† |
| Below poverty level¶ | | | | | | | | | |
| Yes | 8.8 (1.8) | 42.1 | 36.5§ | 68.5 | 77.7† | 47.8§ | 73.4 | 55.2§ | 36.4† |
| No | 9.0 (1.6) | 34.2 | 19.6§ | 73.1 | 66.4† | 62.8§ | 80.1 | 40.1§ | 26.0† |
| Married** | | | | | | | | | |
| Yes | 8.8 (1.6) | 31.9 | 20.4‡ | 78.7† | 68.7 | 64.4‡ | 83.9† | 41.2 | 20.4§ |
| No | 9.0 (1.7) | 38.8 | 28.5‡ | 67.8† | 69.3 | 55.9‡ | 74.5† | 47.1 | 35.5§ |
| Employed | | | | | | | | | |
| Yes | 8.9 (1.8) | 33.6 | 22.8 | 78.5† | 70.7 | 66.4§ | 82.0‡ | 36.5§ | 28.2 |
| No | 9.0 (1.6) | 38.2 | 25.8 | 67.1† | 69.3 | 53.2§ | 75.4‡ | 49.7§ | 29.7 |
| Health literacy | | | | | | | | | |
| Low | 9.1 (1.6) | 39.2 | 39.6§ | 58.2§ | 73.2 | 47.1§ | 68.6§ | 59.5§ | 45.1§ |
| Marginal | 9.0 (1.8) | 35.8 | 29.0§ | 70.2§ | 66.8 | 57.6§ | 75.5§ | 43.3§ | 30.5§ |
| Adequate | 8.8 (1.8) | 35.2 | 15.6§ | 78.8§ | 69.6 | 64.4§ | 83.7§ | 37.7§ | 20.9§ |
| Health activation | | | | | | | | | |
| Low | 8.9 (1.8) | 36.1 | 20.8‡ | 72.5 | 69.2 | 61.9‡ | 81.8 | 42.3 | 33.6‡ |
| Moderate | 9.0 (1.6) | 36.9 | 26.1‡ | 70.8 | 70.0 | 58.1‡ | 75.3 | 45.9 | 25.8‡ |
| Adequate | 9.1 (1.5) | 35.0 | 36.7‡ | 72.1 | 72.1 | 44.3‡ | 72.1 | 47.5 | 21.3‡ |
| Number of chronic conditions | | | | | | | | | |
| 1-2 | 9.2 (1.4)‡ | 35.3 | 22.9 | 74.4 | 66.8 | 63.5 | 84.8† | 41.0 | 30.5 |
| ≥3 | 8.8 (1.8)‡ | 36.9 | 25.4 | 70.4 | 71.4 | 56.1 | 74.7† | 46.0 | 28.4 |
| Self-reported health | | | | | | | | | |
| Good to excellent | 9.0 (1.6) | 34.2‡ | 24.8 | 73.6‡ | 68.4 | 60.0 | 78.5 | 42.9 | 26.0§ |
| Fair to poor | 8.9 (1.9) | 43.8‡ | 23.9 | 65.0‡ | 75.2 | 53.3 | 76.6 | 49.6 | 40.4§ |

COVID-19 = coronavirus disease 2019; LEP = limited English proficiency.

* Statistically significant values are shown in bold.

† *P* < 0.01.

‡ *P* < 0.05.

§ *P* < 0.001.

|| Missing data for 23 participants.

¶ Missing data for 3 participants.

** Missing data for 55 participants.

Table 5. Multivariable Models Examining Patient Characteristics and COVID-19 Awareness, Knowledge, Behavior, and Preparedness (n = 599)*

| Variable | Awareness and Concern | | | Knowledge | |
|----------------------------|---|--------------------------|--------------------------|------------------|------------------|
| | Least-Squares Mean (SD) for Seriousness of Threat | Not Worried | Not Likely to Get Sick | Symptoms | Prevention |
| Age group | | | | | |
| <60 y | 8.76 (8.46–9.06) | 1.00 (reference) | – | – | – |
| 60–69 y | 8.82 (8.52–9.11) | 1.17 (0.83–1.66) | 1.12 (0.73–1.74) | 1.04 (0.82–1.32) | 1.06 (0.83–1.34) |
| ≥70 y | 8.97 (8.63–9.32) | 1.02 (0.66–1.57) | 1.57 (0.93–2.63) | 0.91 (0.67–1.23) | 0.96 (0.71–1.30) |
| Sex | | | | | |
| Female | 9.12 (8.87–9.38)† | 1.06 (0.79–1.42) | 1.18 (0.82–1.72) | 1.09 (0.90–1.34) | 1.04 (0.85–1.28) |
| Male | 8.58 (8.29–8.86) | 1.00 (reference) | – | – | – |
| Race | | | | | |
| Black | 8.69 (8.43–8.96) | 1.45 (1.07–1.98)‡ | 1.99 (1.35–2.93)† | 0.86 (0.69–1.09) | 1.02 (0.81–1.28) |
| White | 8.78 (8.56–8.99) | 1.00 (reference) | – | – | – |
| Other | 9.08 (8.52–9.64) | 0.98 (0.53–1.80) | 1.43 (0.72–2.86) | 0.70 (0.43–1.15) | 1.12 (0.73–1.70) |
| Below poverty level | | | | | |
| Yes | 8.67 (8.35–9.00)‡ | 1.26 (0.90–1.76) | 1.64 (1.10–2.45)‡ | 0.91 (0.71–1.17) | 1.05 (0.83–1.34) |
| No | 9.03 (8.78–9.27) | 1.00 (reference) | – | – | – |
| Health literacy | | | | | |
| Low | 9.06 (8.74–9.39) | 0.87 (0.61–1.26) | 1.89 (1.20–2.97)§ | 0.79 (0.60–1.04) | 1.00 (0.77–1.30) |
| Marginal | 8.76 (8.44–9.08) | 0.89 (0.62–1.26) | 1.53 (0.98–2.39) | 0.94 (0.74–1.20) | 0.94 (0.73–1.21) |
| Adequate | 8.73 (8.43–9.02) | 1.00 (reference) | – | – | – |
| Day of survey | | | | | |
| 1 | 8.19 (7.65–8.74) | 1.00 (reference) | – | – | – |
| 2 | 8.75 (8.38–9.12) | 0.75 (0.43–1.31) | 0.58 (0.28–1.21) | 0.96 (0.62–1.47) | 1.07 (0.70–1.64) |
| 3 | 9.02 (8.68–9.36)§ | 0.55 (0.32–0.95)‡ | 0.71 (0.36–1.38) | 0.95 (0.63–1.41) | 0.92 (0.61–1.39) |
| 4 | 8.85 (8.50–9.20)‡ | 0.82 (0.48–1.42) | 0.72 (0.36–1.45) | 1.06 (0.70–1.62) | 0.96 (0.63–1.48) |
| 5 | 9.1 (8.71–9.48)§ | 0.53 (0.30–0.96)‡ | 0.54 (0.26–1.13) | 1.06 (0.69–1.61) | 1.09 (0.71–1.67) |
| 6 | 9.18 (8.82–9.54)† | 0.70 (0.41–1.21) | 0.61 (0.30–1.24) | 0.97 (0.64–1.47) | 0.91 (0.59–1.40) |

COVID-19 = coronavirus disease 2019.

* Model was adjusted for variables in table and study site. Values are risk ratios (95% CIs) unless otherwise stated. Statistically significant values are shown in bold.

† $P < 0.001$.

‡ $P < 0.05$.

§ $P < 0.01$.

RESULTS

Table 3 summarizes respondent characteristics. Participants were older overall, and 59.7% were female. The sample was racially and ethnically diverse, and many participants were socioeconomically disadvantaged: Nearly a third (29.4%) were living below the poverty level. About half of adults had low or marginal health literacy, all had at least 1 chronic condition, and two thirds (66.5%) were living with 3 or more chronic conditions.

COVID-19 Awareness and Concern

All participants had heard of the coronavirus (COVID-19), and most considered the potential threat to be high (Table 2). One in 4 (24.6%) said that they were “very worried” about getting the coronavirus, and 12.9% were not worried at all (Table 2); in contrast, 10.8% said that they were “very worried” about getting influenza, and 35.9% were not worried at all. Half (50.4%) rated their worry about COVID-19 and influenza the same, whereas 42.6% were more worried about getting COVID-19. Very few participants (9.5%)

believed that they would definitely or probably get the coronavirus.

The threat of a COVID-19 outbreak was rated to be more serious by adults aged 70 years or older and by women before adjustment; those with 3 or more chronic conditions rated the threat as less serious than those with fewer conditions (Table 4). Black participants were more likely than white participants to report that they were “not worried at all” about getting the coronavirus; this was also true for those reporting poorer health. Women, black and Hispanic persons, those with LEP, those living below the poverty level, those with lower health literacy, and unmarried persons were significantly more likely to respond that it was “not at all likely” that they would get COVID-19.

In multivariable analyses, women remained more likely than men to rate the seriousness of the COVID-19 threat as high, whereas adults living below the poverty level rated it as less serious than those with higher incomes (Table 5). Respondents' ratings of the seriousness of COVID-19 also significantly increased by day of

Table 5—Continued

| Reported Behavior | | Preparedness | |
|--------------------------|------------------|--------------------------|--------------------------|
| Change in Daily Routine | Changed Plans | Confidence in Government | Not Prepared |
| — | — | — | — |
| 1.04 (0.79, 1.37) | 0.99 (0.78-1.26) | 0.95 (0.70-1.30) | 0.96 (0.65-1.41) |
| 0.92 (0.66-1.29) | 0.98 (0.73-1.30) | 0.89 (0.60-1.31) | 0.94 (0.59-1.50) |
| 0.99 (0.79-1.24) | 1.15 (0.94-1.34) | 1.04 (0.81-1.35) | 0.96 (0.70-1.33) |
| — | — | — | — |
| 0.81 (0.63-1.05) | 0.91 (0.73-1.14) | 0.91 (0.68-1.22) | 1.65 (1.17-2.34)§ |
| — | — | — | — |
| 1.03 (0.64-1.65) | 1.12 (0.76-1.66) | 1.06 (0.64-1.75) | 0.96 (0.46-2.01) |
| 0.78 (0.58-1.04) | 0.93 (0.73-1.18) | 1.13 (0.84-1.53) | 1.03 (0.71-1.50) |
| — | — | — | — |
| 0.76 (0.56-1.05) | 0.84 (0.64-1.09) | 1.58 (1.15-2.18)§ | 1.90 (1.28-2.82)§ |
| 2.63 (1.23-5.59) | 0.89 (0.70-1.13) | 1.11 (0.80-1.53) | 1.36 (0.91-2.04) |
| — | — | — | — |
| — | — | — | — |
| 2.63 (1.23-5.59)‡ | 0.99 (0.63-1.54) | 1.14 (0.64-2.05) | 1.03 (0.49-2.16) |
| 3.06 (1.48-6.33)§ | 1.08 (0.71-1.63) | 1.04 (0.60-1.81) | 1.01 (0.50-2.03) |
| 3.38 (1.61-7.09)§ | 1.16 (0.75-1.78) | 1.25 (0.71-2.20) | 1.17 (0.57-2.41) |
| 3.58 (1.71-7.49)§ | 1.23 (0.80-1.89) | 1.05 (0.58-1.89) | 1.25 (0.61-2.57) |
| 3.36 (1.61-7.02)§ | 1.15 (0.75-1.76) | 1.19 (0.67-2.11) | 1.10 (0.53-2.28) |

interview, with higher ratings at the end of the survey period than at the beginning. Blacks were more likely than whites to be only “a little worried” or “not worried at all” about getting the coronavirus, and black race, living below the poverty level, and low health literacy all remained independently associated with participants’ belief that it was “not at all likely” that they would get sick with COVID-19.

COVID-19 Knowledge

On average, respondents estimated that more than half (53.6%) of infected persons will have only mild symptoms and 14.2% will die of COVID-19 (Table 2). Most participants correctly identified 3 symptoms (71.7%) and 3 ways to prevent infection (69.8%). Women estimated fewer mild cases and more deaths than men (Table 4). This was also true for blacks relative to whites, for those living below the poverty level, and for those with lower health literacy. Participants who were older, black, unmarried, unemployed, or retired; had poorer health; or had lower health literacy showed poorer knowledge of COVID-19 (Table 4). Those who identified as being Hispanic and having LEP demonstrated greater COVID-19 knowledge. After multivariable adjustment, patient characteristics were no longer associated with knowledge of COVID-19 symptoms or means of prevention (Table 5).

Related Behaviors

More than half of patients (58.6%) reported that the coronavirus had caused them to change their daily routine “a lot,” whereas 78.1% said that they had changed existing plans as a result (Table 2). Men; black persons; those with LEP, lower health literacy, or 3 or more chronic conditions; those living below the poverty level; and persons who were unmarried, unemployed, or retired were less likely to make changes because of the coronavirus (Table 4). After multivariable adjustment, these patient factors were no longer associated with changes to either daily routine or existing plans. In contrast, respondents who were interviewed later in the 1-week survey period were more likely to report that their daily routine had changed “a lot” (Table 5).

Preparedness for a COVID-19 Outbreak

One in 5 respondents (20.8%) reported that they were “very prepared” for a widespread outbreak. Nearly a third (29.1%) had no confidence that the federal government could prevent a nationwide outbreak; 10.2% were very confident (Table 2). Black and Hispanic adults; those with LEP, lower health literacy, lower health activation, or poorer health; those living below the poverty level; and those who were unmarried, unemployed, or retired were more likely to con-

sider themselves either “a little prepared” or “not prepared at all” (Table 4). In multivariable analyses, black race and low health literacy were both independently associated with a greater likelihood of feeling only “a little prepared” or “not prepared at all” (Table 5).

Hispanic persons, those with LEP, those living below the poverty level, and those with lower health literacy were also more likely to be “somewhat” or “very” confident in the federal government. In multivariable analyses, only low health literacy remained associated with feeling “somewhat” or “very” confident in the federal government’s ability to prevent a nationwide outbreak (Table 5).

DISCUSSION

In a survey of more than 600 sociodemographically diverse adults with chronic health conditions living in Chicago, we found that most respondents perceived the threat of a COVID-19 outbreak to be serious, although the level of worry varied; half equated the threat with that of influenza, and only a few reported being more worried about getting influenza than COVID-19. Nearly one third could not identify symptoms or proper measures to prevent infection. Most respondents reported that the virus was affecting their daily routine and leading to changes in already made plans, yet 1 in 5 adults believed that it had little or no effect on their lives or plans. Nearly 1 in 3 participants believed that they were only a little or not at all prepared for a COVID-19 outbreak, whereas just 1 in 5 believed that they were very prepared. Only 1 in 10 respondents was very confident that the federal government could prevent a nationwide outbreak of this virus.

At the time of writing, Illinois ranks seventh in the United States with more than 6980 COVID-19 cases, and 141 state residents have died. When our C3 survey started on 13 March 2020, there were only 46 cases and no deaths; by the end of the survey on 20 March, there were 585 cases and 5 deaths. Across the United States and worldwide, the outbreak was increasing at a rate of 40% to 50% more new cases daily during the week of the interviews. At the same time, several measures were announced in succession: Schools began closing across Illinois, employers were sending staff home to work remotely, various public restrictions were implemented (bar and restaurant closures and limitations on gatherings), and ultimately a “shelter at home” order was announced. Thus, our findings provide a rare snapshot of how a cohort of mostly middle-aged and older adults with underlying health conditions adapted to this unprecedented time and took action, or not. Our study identified concerning demographic and socioeconomic differences in how individuals perceived the threat of COVID-19 and, perhaps, their own ability to take actions to prevent illness. Specifically, those who were black, were living below the poverty level, and had low health literacy were less likely to believe that they might become infected, and black respondents were less worried about the pandemic. Black adults

also felt less prepared for an outbreak than white adults, and individuals with low health literacy reported not only being less prepared but also having more confidence in the federal government response.

Although the reasons for these findings are not clear, similar results were reported during the H1N1 influenza pandemic in 2009 (14). Trust in public health officials, information-seeking behaviors, sources of information, frequency of media exposure, knowledge, and worry related to the outbreak were all highlighted determinants of documented disparities in uptake of recommended behaviors. In our study, disparities by race, socioeconomic status, and health literacy were not reflected in ratings of the seriousness of the COVID-19 threat, demonstrated knowledge of its symptom presentation or general means to prevent it, or reported changes to daily routines and plans. Prior research has documented racial differences pertaining to trust in the health care system (15–17). For those who are living below the poverty level or have low health literacy, perceptions of personal risk and the ability to prevent infection may be limited. This may be due to feeling less able to change one’s social circumstance, or lack of public health communications that are explicit and actionable and provide clear, efficacious messaging pertaining to recommended protective behaviors (18, 19). A previous report found socioeconomic and literacy disparities in mortality associated with the 1918 influenza pandemic; likewise, our findings should raise caution (20). Although the current public health infrastructure is different, existing efforts may not be adequately reaching these vulnerable populations.

Our study, working to quickly capture the opportunity to understand how the most vulnerable are processing current events, clearly has limitations. First, this survey was done among a selected group of patients who were all active participants in cohort studies or clinical trials sponsored by the National Institutes of Health in 1 large U.S. city. Thus, these findings may have limited generalizability, especially for younger adults and those without underlying health conditions. However, our study samples purposefully include men and women who are socioeconomically, racially, and ethnically diverse and are at greatest risk for COVID-19 because of age and underlying conditions. Second, to rapidly implement our investigation and quickly recruit as large a sample as possible during the first of multiple waves of interviews, we were limited in the depth of our survey and number of items to use. Prior research on virus outbreaks guided our selection and creation of survey items (12), but we lacked the time or opportunity to validate all questions, particularly in the midst of a public health crisis. However, items followed best practices for the design of assessments for use among persons with lower literacy (21). Third, our outcomes capture only initial awareness of COVID-19, degree of worry, fundamental knowledge, attitudes, and a limited set of behaviors. Understanding of the virus has since evolved, and we could not expand on those developments. Items included in planned follow-up waves of

the survey will adapt accordingly and expand data capture on behaviors, among other just-in-time topics.

Finally, as a time-sensitive study, what we have learned in this initial, critical week, when COVID-19 most fully took hold in the United States, is that public health messaging has dramatically changed: New policies, state restrictions, and information are being shared not just daily but hourly. It is likely that all of what we report in this 1-week glimpse has considerably altered. Regardless, our findings depict the initial lack of clarity in understanding, perceived susceptibility, and personal efficacy regarding the pandemic among those at greatest risk. That is why we intend to continue to follow this cohort as part of an ongoing C3 initiative.

This first wave of the C3 study revealed profound gaps in awareness, knowledge, concern, and preemptive public health action. The potential for the COVID-19 pandemic to exacerbate health disparities—potentially through mechanisms related to inadequate or conflicting public health messaging among those who are socioeconomically disadvantaged, belong to racial minority groups, or have more limited health literacy—may be exceptionally high. Actions are needed now to ensure that as the pandemic unfolds, all citizens are adequately made aware of the gravity of the threat; with great clarity and attention to health literacy best practices, we need to explain specific steps that must be taken to avoid harm.

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Reproducible Research Statement: *Study protocol and statistical code:* Available from Dr. Wolf (e-mail, mswolf@northwestern.edu). *Data set:* Available to those who meet prespecified criteria; access allowed to deidentified data only. Available from Dr. Wolf (e-mail, mswolf@northwestern.edu).

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