Supplement Article: The Impact, Experience, and Challenges of COVID-19: The Women’s Health Initiative

The Impact of the COVID-19 Pandemic on Older Women in the Women’s Health Initiative

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Abstract

Background: The coronavirus disease 2019 (COVID-19) pandemic is a health crisis of which older adults are a high-risk group for severe illness and mortality. The objectives of this article are to describe the methods and responses to a COVID-19 survey administered by the Women’s Health Initiative (WHI) to assess the impact of the pandemic on older women.

Methods: WHI is an ongoing prospective cohort study that recruited 161,808 postmenopausal women from 1993 to 1998. From June 2020 to October 2020, participants in active follow-up were surveyed by mail, phone, or online to assess health and well-being, living situations, lifestyle, health care, and self-reported COVID-19 testing, treatment, and preventive behaviors.

Results: Of 64,061 eligible participants, 49,695 (average age 83.6 years ± 5.6) completed the COVID-19 survey (response rate 77.6%). Many participants reported very good or good well-being (75.6%). Respondents reported being very concerned about the pandemic (51.1%; more common in urban compared to rural areas), with 6.9% reporting disruptions in living arrangements and 9.7% reporting changes in medication access. Participants (54.4%) reported physical activity levels were much less or somewhat less compared to levels before the pandemic, and this was more pronounced in urban areas versus rural areas (55.3% vs 44.4%). Participants engaged in preventive behaviors including wearing a face mask (93.2%). A total of 18.9% reported testing for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), among whom 3.5% (n = 311) reported testing positive.

Conclusions: In this nationwide survey of older U.S. women, the COVID-19 pandemic was associated with impacts on health and well-being, living situations, lifestyle, health care access, and SARS-CoV-2 testing and preventive behaviors.

Keywords: Cohort study, Living arrangements, Well-being

By February 2022, there have been over 75 million cases of coronavirus disease 2019 (COVID-19) and over 888,000 COVID-19 deaths in the United States (1). Risk factors for severe illness from COVID-19 include older age (particularly ages 75 years and older), preexisting conditions (e.g., cancer, heart disease, chronic kidney disease, chronic obstructive pulmonary disease, and type 2 diabetes),
obesity, and smoking (2–5). While the reasons underlying the increased risk for older age groups are not fully understood, factors including high systolic blood pressure, frailty, obesity, and having multiple long-term conditions (eg, depression, heart disease) have been shown to explain some of the excess risk in COVID-19 mortality (3,6).

In addition to COVID-19 morbidity and mortality, the pandemic has been associated with disruptions in everyday life that have important implications for access to health care and medications, mental health, physical activity, and living situations (7–11). Older individuals represent an especially vulnerable population affected by disruptions due to COVID-19 such as social distancing and stay-at-home orders (8). To date, there has been limited research detailing the personal and economic consequences associated with the pandemic on older individuals in the United States. Starting in June 2020, the Women's Health Initiative (WHI), a nationwide prospective cohort of postmenopausal women, sent a survey to participants which included questions regarding their experiences related to the pandemic. The objectives of this article are to describe the survey methods and to report selected population characteristics and survey responses to describe the direct and indirect effects of the pandemic on the lives of older women, including disruptions in health and well-being, living situations, lifestyle factors, and health care, as well as self-reported COVID-19 testing, diagnoses, treatment, and preventive behaviors.

Method
Study Population
The WHI is a nationwide prospective cohort study funded by the National Heart, Lung, and Blood Institute that included clinical trials (CTs) and an observational study (OS) from 1993 to 2005 with overall objectives of identifying risk factors for and testing interventions to prevent the major causes of morbidity and mortality in postmenopausal women (12,13). Between 1993 and 1998, WHI investigators at 40 U.S. clinical centers enrolled 161 808 generally healthy postmenopausal women aged 50–79 years (12). At the conclusion of the CTs in 2005, CTs and OS participants were invited to consent for further follow up in the WHI Extension Studies. Throughout the WHI, these women have provided extensive information including demographics, medical history, diet, medication and supplement use, lifestyle, psychosocial and behavioral measures, selected environmental factors, as well as blood and buffy coat (DNA) samples. At the beginning of the pandemic, 64 061 women remained alive and were in active follow up. Annual follow-up rates have been very high (>86%) and passive follow-up through linkages to Medicare and the National Death Index (NDI) is conducted annually. The Institutional Review Board at each study site approved the protocols and participants provided written informed consent.

COVID-19 Survey
From June 2020 to October 2020, active WHI participants were sent a COVID-19 survey, which included questions on the following topics: changes in living arrangements; household composition; residence-based restrictions; severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus exposures, testing, diagnoses, medical care, and preventive behaviors; medications; health conditions; health care access; health and general well-being; pandemic-related concerns; communication with friends and family; lifestyle factors including alcohol consumption, smoking, and physical activity; and community actions to help during the pandemic (14). The survey was first administered online (using REDCap) to participants who provided email addresses, and subsequently by mail and phone. In June 2020, the first online survey invitations were sent to participants. Phone-based surveys (for those who are followed by phone) were initiated later in June. From July 2020 to August 2020, the paper version was mailed. In September 2020, a remail of the paper survey was sent to online and mail nonrespondents. Phone follow-up was conducted among nonrespondents (with a few exceptions) who were initially contacted by phone and those who had not responded to online and paper remailings. Budget limitations precluded phoning all nonrespondents to mail and online, so these efforts were directed at underrepresented minorities and those greater than 90 years of age to ensure representation of those important subgroups.

Statistical Analysis
Chi-square tests and t tests for categorical and continuous variables, respectively, were used to compare differences in WHI population characteristics and selected COVID-19 survey responses between survey respondents versus nonrespondents and by rural versus urban residence, region of residence, and/or time period of survey completion (surveys completed from June 2020 to August 2020 were classified as Summer 2020 and surveys completed from September 2020 to October 2020 were classified as Fall 2020). All questions included in the COVID-19 survey are available online (14). Questions allowing multiple responses are indicated in the Tables. The current ZIP code collected in the COVID-19 survey was used to determine rural/urban residence using U.S. Department of Agriculture Rural-Urban Commuting Area (RUCA) codes, which classify all ZIP codes into one of 10 main categories for metropolitan, micropolitan, small town, and rural commuting areas based on measures of population density, urbanization, and daily commuting (15). There are also 33 subcategories based on secondary commuting flows. Due to the small number of participants in the rural categories, we presented results for urban residence (RUCA codes for metropolitan: 1.0, 1.1, 2.0, 2.1, 3.0, 4.1, 5.1, 7.1, 8.1, 9.1, and 10.1) and rural residence (RUCA codes for micropolitan: 4.0, 4.2, 5.0, 5.2, 6.0, and 6.1; small rural town: 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, and 9.2; isolated small rural town: 10.0, 10.2, 10.3, 10.4, 10.5, and 10.6). There were 132 participants for whom RUCA codes were missing because of an invalid ZIP code (n = 129) or the RUCA code was 99 or zero population (n = 3). ZIP codes were also used to determine the U.S. Census region of residence (Northeast, South, Midwest, and West).

In addition, the current ZIP code was used to map the geographic distribution of participant responses to question 21 of the COVID-19 survey (“In general, how concerned are you about the COVID-19 pandemic?”) (14). As multiple participants may have resided in the same ZIP code, the mode response was determined for each ZIP code (not at all concerned, somewhat concerned, or very concerned). A total of 241 responses were excluded because the reported ZIP code was not available in the 2020 U.S. Census Bureau TIGER/Line shapefile boundaries for ZIP code Tabulation Areas (16). All spatial analyses were conducted using ArcGIS 10.7 (Esri, Redlands, CA).

Responses to 4 questions (27–30) of the COVID-19 survey were used to estimate the perceived stress scale construct, which measures the degree to which situations in one’s life are appraised as stressful. This was a 4-item version of the 14-item Perceived Stress Scale instrument (17), where the score values range from 0 to 16 (a higher score indicates greater perceived stress). In addition to the information
collected from the COVID-19 survey, the following variables are presented, which were collected using standardized questionnaires at baseline: age at survey completion (years; calculated using birthdate), ethnicity (non-Hispanic/Latina, Hispanic/Latina, unknown/not reported), race (American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, Black, White, more than 1 race, unknown/not reported), and education (less than high school, high school diploma or GED, some school after high school, and college degree or higher). We also used data from follow-up questionnaires collected prior to the COVID-19 survey to ascertain the following information: body mass index (BMI; kg/m²) from most recent data collection, alcohol consumption from most recent data collection, any cancer except nonmelanoma skin cancer, any fracture, autoimmune disease (includes lupus and rheumatoid arthritis), breast cancer, chronic obstructive pulmonary disease, coronary disease (includes myocardial infarction [MI], revascularization [percutaneous coronary intervention or coronary artery bypass grafting], angina, or heart failure), current depression (Burnam score ≥0.06 from most recent data collection) [18], lifetime depression (Burnam score ≥0.06 or antidepressant medication use reported at baseline or at any time during follow-up prior to the COVID-19 survey), MI, osteoarthritis, stroke, treated diabetes, and treated hypertension. Comorbidities were identified based on adjudicated events during follow-up or self-reported disease history [19].

We conducted sensitivity analyses using inverse probability weighting (IPW) to examine the potential impact of selection bias from women who did not respond to the COVID-19 survey. The inverse probability weights were estimated by regressing a binary response variable (responded to survey vs not) on a set of covariates including demographic characteristics, medical history, and psychosocial variables in a logistic regression model. Statistical tests were conducted in separate logistic regression models in which the response variable was urban versus rural residence (weighted as described above). All statistical tests were 2-sided and \( p < .05 \) was considered statistically significant. Statistical analyses were conducted using SAS 9.4 (Cary, NC).

Results

Population Characteristics

Table 1 shows population characteristics for the participants who completed the COVID-19 survey. Among 64,061 participants who were eligible for contact, a total of 49,695 participants responded to the survey (response rate 77.6%; Supplementary Figure 1). The majority of respondents completed the survey by mail (72.6%), followed by online (26.3%), and phone (1.1%). Most surveys were completed in August 2020 (54.1%). Overall, participants were on average 83.6 years old (±5.6) and had an average BMI of 26.1 kg/m² (±5.2). The majority of participants were non-Hispanic (96.9%, \( n = 48,151 \)), 2.9%, \( n = 1,444 \) were Hispanic, White (89.9%; 0.2%, \( n = 106 \) were American Indian/Alaska Native; 2.2%, \( n = 1,087 \) were Asian; 0.1%, \( n = 35 \) were Native Hawaiian/Other Pacific Islander; 5.6%, \( n = 2,792 \) were Black; 1.1%, \( n = 570 \) were more than 1 race), and/or had a college degree or higher (49.7%, \( n = 24,513 \)), 1.9%, \( n = 920 \) had less than a high school education; 13.5%, \( n = 6,680 \) had a high school diploma or GED; 34.9%, \( n = 17,244 \) had some school after high school). Women were more likely to have resided in the West region of the United States (29.4%), followed by the South (27.0%), Midwest (22.2%), and Northeast (21.3%). Participants residing in rural areas were slightly more likely to be White and/or live in the Midwest and less likely to have a college degree or higher compared to participants residing in urban areas (\( p < .0001 \)). Participants who did not complete the survey (\( n = 14,665 \)) were slightly older, more likely to be Black, and less likely to have a college degree or higher (\( p < .0001 \)).

Well-being, Living Situations, Medications, and Health Care

Many participants reported that their current level of well-being from March 2020 to October 2020 during the COVID-19 pandemic was very good (38.7%) or good (36.9%; Table 2). Supplementary Table 1 shows current level of well-being stratified by region of residence and season of survey completion. A relatively lower proportion of participants who responded to the survey in Fall 2020 compared to Summer 2020 reported an excellent, very good, or good current level of well-being (\( p < .0001 \)). Respondents reported being very concerned about the pandemic (51.1%), which was slightly more common in urban compared to rural areas (51.5% vs 46.7%; \( p < .0001 \)). Figure 1 shows the geographic distribution of the most frequently reported level of concern by participant ZIP code, many of which were characterized by responses of somewhat or very concerned. Respondents resided in all 50 states across the United States and Washington, DC. The following were reported by participants as major concerns: the nation and economy more generally (69.5%), risk of family or friends getting infected (67.3%), risk of themselves getting infected (62.1%), ability to be with family and friends (61.4%), and/or the health and safety of friends and family (58.8%; Table 2). Urban compared to rural residents were slightly more concerned with getting infection (62.4% vs 58.2%) and getting enough physical activity or exercise (24.0% vs 14.9%; \( p < .0001 \)). The average perceived stress scale among participants was 4.8 (±2.9; responses used to calculate perceived stress are presented in Supplementary Table 2). Approximately 6.9% of women reported a change in living arrangements since March 2020 due to the pandemic, which included having family or friends move in (18.2%) and/or they moved in with other family or friends (13.1%), the latter being more common among rural residents (Table 2). Some participants moved into a care facility (8.6%) and/or had a care provider coming to help (7.0%). Respondents in the fall compared to the summer were more likely to have reported moving in with other family or friends, have their care provider now coming to help (particularly in the Northeast and West), and/or moved into a care facility themselves (particularly in the Midwest and South; \( p < .0001 \); Supplementary Table 1). Living in a private home (where services and/or restrictions were not applicable) was more common among rural compared to urban participants (84.5% vs 75.8%; \( p < .0001 \)). For participants who did not live in a private home, 11.4% reported that their place of residence was not allowing visitors and 11.6% reported having food delivered to the home/apartment/room (Supplementary Table 3). Of the participants who had close family members in assisted living, skilled nursing, or a nursing home (8.9%), around 10.8% reported being able to visit them, with a higher proportion of respondents in the fall having reported being able to visit and the lowest proportions reported in the South (irrespective of time period; Supplementary Table 1).

The majority of participants reported taking prescription medications not related to COVID-19 (88.0%; Supplementary Table 3). A total of 9.7% of participants reported any change in how they received their medications since March 2020, with difficulties taking
### Table 1. Population Characteristics for WHI Participants: Overall and by Rural/Urban Residence

|                          | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | Did Not Complete Survey (N = 14,655) |
|--------------------------|-----------------------|-------------------------------|-----------------------------|---------------------------------------|
|                          | N %                   | N %                           | N %                         | N %                                  |
| Age at survey completion (years), mean (SD) | 83.6 5.6 | 83.3 5.5 | 83.6 5.6 | .0009 | 86.5 6.0 | .0001 |
| 70–74                    | 993 2.0 | 81 2.1 | 907 2.0 | .0611 | 167 1.1 | .0001 |
| 75–79                    | 12,324 24.8 | 1,028 26.2 | 11,261 24.7 | 3,518 24.0 | 4,059 27.7 | .0001 |
| 80–84                    | 16,083 32.4 | 1,284 32.7 | 14,754 32.3 | 3,540 24.2 | 1,416 9.7 | .0001 |
| 85–89                    | 12,160 24.5 | 937 23.9 | 11,191 24.5 | 4,059 27.7 | 1,416 9.7 | .0001 |
| 90–94                    | 6,445 13.0 | 484 12.3 | 5,949 13.0 | 3,540 24.2 | 1,416 9.7 | .0001 |
| ≥95                      | 1,690 3.4 | 109 2.8 | 1,578 3.5 | 4,059 27.7 | 1,416 9.7 | .0001 |
| Body mass index at survey completion (kg/m²), mean (SD) | 26.1 5.2 | 26.5 5.3 | 26.0 5.2 | <.0001 | 25.9 5.6 | .0004 |
| <25                      | 23,154 47.8 | 1,669 43.5 | 21,437 48.2 | 5,735 50.1 | 3,495 30.5 | .0001 |
| 25–<30                   | 15,708 32.4 | 1,309 34.1 | 14,365 32.3 | 3,495 30.5 | 2,214 19.3 | .0001 |
| ≥30                      | 9,564 19.7 | 859 22.4 | 8,680 19.5 | 3,495 30.5 | 2,214 19.3 | .0001 |
| Ethnicity                |                      |                               |                             |                                       |
| Non-Hispanic/Latina      | 48,151 96.9 | 3,878 98.9 | 44,159 96.8 | 14,030 95.7 | 3,495 30.5 | .0001 |
| Hispanic/Latina          | 1,444 2.9 | 41 1.0 | 1,385 3.0 | 590 4.0 | 35 0.2 | .0001 |
| Unknown/not reported     | 100 0.2 | 4 0.1 | 96 0.2 | 35 0.2 | .0001 |
| Race                     |                      |                               |                             |                                       |
| American Indian/Alaska Native | 106 0.2 | 22 0.6 | 83 0.2 | 40 0.3 | 35 0.1 | .0001 |
| Asian                    | 1,087 2.2 | 18 0.5 | 1,068 2.3 | 309 2.1 | 18 0.1 | .0001 |
| Native Hawaiian/other Pacific Islander | 35 0.7 | 3 0.1 | 32 0.1 | 18 0.1 | 3 0.1 | .0001 |
| Black                    | 2,792 5.6 | 72 1.8 | 2,711 5.9 | 1,538 10.5 | 18 0.1 | .0001 |
| White                    | 44,672 89.9 | 3,748 95.5 | 40,814 89.4 | 12,369 84.4 | 216 1.5 | .0001 |
| More than 1 race         | 570 1.1 | 46 1.2 | 521 1.1 | 216 1.5 | 200 1.1 | .0001 |
| Unknown/not reported     | 433 0.9 | 14 0.4 | 411 0.9 | 165 1.1 | .0001 |
| Years of education       |                      |                               |                             |                                       |
| Less than high school    | 920 1.9 | 79 2.0 | 839 1.9 | 598 4.1 | 39 0.1 | .0001 |
| High school diploma or GED | 6,680 13.5 | 678 17.4 | 5,988 13.2 | 2,551 17.5 | 5,496 37.7 | .0001 |
| Some school after high school | 17,244 34.9 | 1,530 39.2 | 15,662 34.6 | 5,922 40.7 | 5,496 37.7 | .0001 |
| College degree or higher | 24,513 49.7 | 1,615 41.4 | 22,835 50.4 | 5,922 40.7 | 5,496 37.7 | .0001 |
| Month of survey completion* |              |                               |                             |                                       |
| June                     | 13,043 26.2 | 939 23.9 | 12,076 26.5 | .0142 | 10,155 22.3 | .0001 |
| July                     | 2,498 0.5 | 18 0.5 | 2,100 0.5 | 10,155 22.3 | 2,551 17.5 | .0001 |
| August                   | 26,862 54.1 | 2,207 56.3 | 24,612 53.9 | 5,922 40.7 | 5,496 37.7 | .0001 |
| September                | 6,372 12.8 | 506 12.9 | 5,830 12.8 | 5,922 40.7 | 5,496 37.7 | .0001 |
| October                  | 3,177 6.4 | 253 6.4 | 2,912 6.4 | 5,922 40.7 | 5,496 37.7 | .0001 |
| Survey mode              |                      |                               |                             |                                       |
| Online                   | 13,072 26.3 | 940 24.0 | 12,109 26.5 | .0020 | 10,155 22.3 | .0001 |
| Paper                    | 36,056 72.6 | 2,942 75.0 | 33,047 72.4 | 5,922 40.7 | 5,496 37.7 | .0001 |
| Phone                    | 567 1.1 | 41 1.0 | 484 1.1 | 5,922 40.7 | 5,496 37.7 | .0001 |
| Region of residence      |                      |                               |                             |                                       |
| Northeast                | 10,570 21.3 | 412 10.5 | 10,155 22.3 | .0001 | 10,155 22.3 | .0001 |
| Midwest                  | 11,025 22.2 | 1,580 40.3 | 9,445 20.7 | .0001 | 10,155 22.3 | .0001 |
| South                    | 13,374 27.0 | 1,051 26.8 | 12,323 27.0 | 5,922 40.7 | 5,496 37.7 | .0001 |
| West                     | 14,597 29.4 | 880 22.4 | 13,717 30.1 | 5,922 40.7 | 5,496 37.7 | .0001 |

Notes: SD = standard deviation; WHI = Women’s Health Initiative; GED = General Educational Development test.

*Survey completion in July is relatively lower compared to other months because the majority of online surveys were completed in June (initial REDCap invitations were sent June 5, 2020), a small number of phone follow-up results were completed in July (phone follow-up began on June 18, 2020), and due to the duration for mail responses to be sent and returned (paper surveys were mailed from July 13, 2020 to August 5, 2020).
medications due to delays in getting prescriptions filled (37.6%). Many participants had health care appointments scheduled from March 2020 up until survey completion (79.4%) that were affected by the pandemic. Of these women, nearly half reported appointment conversions to telephone or online, slightly over one third reported appointments being rescheduled, and about a quarter reported appointment cancelations (all of which were more commonly reported among urban compared to rural residents, \( p < .0001 \)). Although participants were more likely to report no difficulty in receiving routine care since March 2020 (75.5%), 21.9% reported some difficulty.

Pandemic-related Preventive Behaviors, New Actions, and Social Engagement

The majority of participants took steps since March 2020 to reduce risk of infection, including wearing a face mask in public (93.2%), washing hands frequently (90.6%), maintaining physical distance from people outside of their household (89.2%), avoiding shaking hands (80.8%), and/or staying at home (78.9%; Table 2). Rural participants were less likely to avoid in-person social/religious activities compared to urban participants (68.1% vs 74.6%; \( p < .0001 \)). Participants responding in the fall compared to the summer were slightly less likely to engage in steps since March 2020 to reduce risk of infection such as washing hands frequently and/or avoiding shaking hands (\( p < .0001 \); Supplementary Table 1). Respondents reported taking new actions to help family, friends, or their community during the pandemic, including contacting friends or family to keep in touch (71.0%), donating money (30.4%), making masks for others (11.3%), and/or getting food or medicine for others (10.0%). Over half of participants reported communicating with others outside of their home every day or several times per week (Table 2).

Lifestyle Factors: Alcohol Consumption, Smoking, and Physical Activity

Within the past 3 months of completing the survey, over half of respondents did not consume alcohol (52.2%), although 13.2% consumed an average of 5–7 drinks per week and 3.4% consumed an average of more than 7 drinks per week (Table 3). Alcohol consumption reported in the COVID-19 survey was lower (47.8%) compared to prior to the pandemic (72.7%; Supplementary Table 4), which did not meaningfully differ by rural versus urban residence. A small proportion of respondents (1.3%) reported currently smoking regular or electronic cigarettes during the pandemic.

Participants reported a level of physical activity or exercise that was much less (25.7%), somewhat less (28.7%), or about the same (37.3%) compared to before the pandemic (Table 3). In the past month of completing the survey, some women (23.2%) reported rarely or never walking outside of their homes (or equivalent) for at least 5 minutes without stopping, while 18.5% reported walking 7 or more times per week. Participants residing in urban compared to rural areas were more likely to report much less or somewhat less physical activity or exercise compared to before the pandemic (55.3% vs 44.4%; \( p < .0001 \)).

COVID-19 Testing, Diagnoses, and Treatment

Most participants were never exposed to another person diagnosed or suspected of having a SARS-CoV-2 infection (96.2%; Table 4). Five percent reported having a family member or close friend die from COVID-19. A total of 18.9% reported being tested for SARS-CoV-2, most of whom were tested using nasal swabs (86.6%) and/or were tested once (71.9%). A total of 3.5% of these participants (\( n = 311 \)) reported a positive test result, 79.6% of which were through nasal swabs. Of 71% of those who reported testing positive reported ever being hospitalized for COVID-19. Regarding temporal and regional differences in testing, a higher proportion of respondents in the fall compared to the summer reported testing for SARS-CoV-2 (\( p < .0001 \)), which was generally consistent across the Northeast, Midwest, South, and West regions of the United States (Supplementary Table 1).

Other information regarding participant characteristics or collected from the COVID-19 survey, including comorbidities (Supplementary Table 5), housing, medication, and social impacts (Supplementary Table 6), and COVID-19 health care (Supplementary Table 7), are included as Supplementary Material. Results were similar when applying IPW to address potential selection bias from nonrespondents (data not shown).

Discussion

In this nationwide survey of United States older women aged on average 83.6 years, we described survey methods and the experiences of the COVID-19 pandemic using a range of measures regarding health and well-being, living situations, lifestyle factors, and health care. Responses were collected from March 2020 to October 2020, which was during the first wave of the pandemic, although the impact of the pandemic (eg, infection rates and lockdown measures) varied from location to location across the United States (20). WHI participants were more likely to report very good or good levels of well-being, but in lower frequency in the fall compared to the summer. Respondents reported being very concerned about the pandemic (more commonly reported among urban residents), with many participating in preventive behaviors including wearing a face mask (which were more commonly practiced in the summer compared to the fall). The most common disruption in living arrangements included having family or friends move in, although a higher proportion of respondents in the fall compared to the summer reported moving into a care facility and/or having their care provider come to help. Many women reported changes in medication and health...
| Current level of well-being       | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
|----------------------------------|----------------------|----------------------------|----------------------------|---------|
| Excellent                        | 4,915 (10.0)         | 390 (10.0)                 | 4,512 (10.0)                | .6576   |
| Very good                        | 19,045 (38.7)        | 1,543 (39.7)               | 17,465 (38.7)               |         |
| Good                             | 18,151 (36.9)        | 1,414 (36.4)               | 16,680 (37.0)               |         |
| Fair                             | 5,967 (12.1)         | 462 (11.9)                 | 5,485 (12.2)                |         |
| Poor                             | 901 (1.8)            | 62 (1.6)                   | 838 (1.9)                   |         |
| Very poor                        | 171 (0.3)            | 16 (0.4)                   | 155 (0.3)                   |         |

| How concerned about the COVID-19 pandemic       | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
|--------------------------------------------------|----------------------|----------------------------|----------------------------|---------|
| Not at all concerned                             | 3,245 (6.8)          | 297 (7.8)                  | 2,937 (6.7)                 | <.0001  |
| Somewhat concerned                               | 20,247 (42.2)        | 1,726 (45.5)               | 18,454 (41.8)               |         |
| Very concerned                                   | 24,533 (51.1)        | 1,774 (47.6)               | 22,709 (51.5)               |         |

| Pandemic causing concerns about the following* | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
|-----------------------------------------------|----------------------|----------------------------|----------------------------|---------|
| Risk of getting COVID-19 infection           | 30,849 (62.1)        | 2,283 (58.2)               | 28,476 (62.4)               | <.0001  |
| Risk of family/friends getting COVID-19 infection | 33,448 (67.3)        | 2,570 (65.5)               | 30,806 (67.5)               | .0109   |
| Getting the health care I need               | 5,714 (11.5)         | 366 (9.3)                  | 5,338 (11.7)                | <.0001  |
| Getting adequate food                         | 3,813 (7.7)          | 224 (5.7)                  | 3,578 (7.8)                 | <.0001  |
| Getting enough exercise/physical activity     | 11,587 (23.3)        | 586 (14.9)                 | 26,933 (59.0)               | .0089   |
| Getting the sleep I need                      | 3,795 (7.6)          | 235 (6.0)                  | 3,547 (7.8)                 | <.0001  |
| Pandemic causing concerns about the following* | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
| Financial security                            | 5,168 (10.4)         | 344 (8.8)                  | 4,807 (10.5)                | .0005   |
| Ability to be with family and friends         | 30,533 (61.4)        | 2,300 (58.6)               | 28,167 (61.7)               | <.0001  |
|Nation and economy more generally              | 34,561 (69.5)        | 2,723 (69.4)               | 31,764 (69.6)               | .0839   |
| Perceived stress scale, mean (SD)             | 4.8 (2.9)            | 4.6 (2.9)                  | 4.8 (2.9)                   | .0023   |

| Steps taken since March 2020 to reduce risk of infection by COVID-19* | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
|---------------------------------------------------------------------|----------------------|----------------------------|----------------------------|---------|
| Washing hands frequently                                           | 45,019 (90.6)        | 3,564 (90.8)               | 41,355 (90.6)               | .5625   |
| Trying not to touch face                                           | 35,157 (64.7)        | 2,440 (62.2)               | 32,617 (64.9)               | .0006   |
| Disinfecting surfaces frequently                                   | 25,227 (50.8)        | 1,960 (50.0)               | 23,267 (50.8)               | .2951   |
| Maintaining physical distance from people outside household         | 44,344 (89.2)        | 3,431 (87.5)               | 40,913 (89.4)               | .0001   |
| Wearing a face mask in public                                      | 46,309 (93.2)        | 3,607 (91.9)               | 42,692 (93.3)               | .0009   |
| Wearing gloves in public                                           | 9,517 (19.2)         | 555 (14.1)                 | 8,962 (19.6)                | <.0001  |
| Avoiding in-person social/religious activities                      | 36,786 (74.0)        | 2,630 (67.0)               | 34,136 (74.0)               | .0001   |
| Avoiding or limiting in-person shopping                            | 34,828 (70.1)        | 2,630 (67.0)               | 32,122 (70.4)               | <.0001  |
| Avoiding shaking hands                                             | 40,159 (80.8)        | 3,072 (78.3)               | 36,999 (81.1)               | <.0001  |
| Staying home                                                       | 39,210 (78.9)        | 3,022 (77.0)               | 36,085 (79.1)               | .0028   |

Notes: COVID-19 = coronavirus disease 2019; SD = standard deviation.

*The COVID-19 survey allowed participants to mark multiple responses to this question.
Table 3. Lifestyle Factors During the COVID-19 Pandemic: Overall and by Rural/Urban Residence

|                                      | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
|--------------------------------------|-----------------------|-----------------------------|-------------------------------|---------|
|                                      | N                     | %                           | N                             | %       | p value |
| In past 3 months, average number of alcoholic drinks |                       |                             |                               |         |
| None                                 | 26,600                | 52.2                        | 2,168                         | 56.1    | <.0001  |
| At most 1 drink each week             | 9,103                 | 18.6                        | 672                           | 17.4    | 8,413   | 18.7   |
| 2–4 drinks per week                  | 6,142                 | 12.5                        | 446                           | 11.5    | 5,674   | 12.6   |
| 5–7 drinks per week                  | 6,483                 | 13.2                        | 451                           | 11.7    | 6,021   | 13.4   |
| More than 7 drinks per week          | 1,674                 | 3.4                         | 127                           | 3.3     | 1,544   | 3.4    |
| Currently smoke regular or electronic cigarettes | 618                   | 1.3                         | 50                            | 1.3     | 565     | 1.3    |
| Over past month, level of physical activity or exercise compared to average before pandemic |                       |                             |                               |         |
| Much less                            | 12,568                | 25.7                        | 733                           | 19.0    | 11,809  | 26.3   |
| Somewhat less                        | 14,051                | 28.7                        | 976                           | 25.4    | 13,027  | 29.0   |
| About the same                       | 18,233                | 37.3                        | 1,778                         | 46.2    | 16,413  | 36.5   |
| Somewhat more                        | 3,226                 | 6.6                         | 281                           | 7.3     | 2,937   | 6.5    |
| Much more                            | 852                   | 1.7                         | 80                            | 2.1     | 768     | 1.7    |
| How often walked outside home or equivalent for at least 5 minutes without stopping |                       |                             |                               |         |
| Rarely or never                      | 11,290                | 23.2                        | 888                           | 23.2    | 10,376  | 23.2   |
| 1 time each week                     | 5,084                 | 10.4                        | 420                           | 11.0    | 4,649   | 10.4   |
| 2–3 times each week                  | 11,392                | 23.4                        | 882                           | 23.0    | 10,471  | 23.4   |
| 4–6 times per week                   | 11,959                | 24.5                        | 955                           | 24.9    | 10,978  | 24.3   |
| 7 or more times per week             | 9,038                 | 18.5                        | 683                           | 17.8    | 8,333   | 18.6   |

Notes: COVID-19 = coronavirus disease 2019.
having moved into a care facility. Participants also reported lower levels of physical activity compared to before the pandemic, especially among women in urban areas. Although stay-at-home orders and closures of nonessential businesses, such as fitness centers, were implemented to reduce transmission of the virus and the overall burden of the pandemic, this disruption minimized opportunities for physical activity, which may have short- and long-term effects on health among older adults (33, 34). Reported levels of alcohol consumption were also lower compared to prior to the pandemic, which has been observed in research showing that U.S. adults aged 21 years and older who reported decreased alcohol consumption during the pandemic cited reasons related to diminished alcohol availability, less free time, and/or having less financial resources (35).

A small proportion of respondents (~10%) reported changes in how they were receiving their prescription drugs since March 2020, while a larger proportion of participants were affected by disruptions in health care appointments such as rescheduling or cancellations. Many reported conversions to telephone or online appointments, which was more common in urban areas. These results highlight geographic disparities in health care services, where telehealth and other technologies are more commonly provided in urban areas compared to rural areas due to barriers regarding the logistics of implementing telehealth, lack of partners or providers, and limited broadband access (36).

This study has several limitations. The generalizability of the results may be limited as WHI participants are generally healthier and of higher socioeconomic status compared to the general U.S. population and the majority of participants are White and/or non-Hispanic. Furthermore, other considerations potentially affecting generalizability include how 41.4% of participants (67,006/161,808) were deceased when COVID-19 survey administration commenced in June 2020 and how WHI participants who were most severely affected by COVID-19 illness may have been less likely to be able to complete the COVID-19 survey. Future research should explore pandemic-related disruptions reported in the WHI compared to other populations. However, given the small number of participants who did report a COVID-19 diagnosis, this is unlikely to have significantly affected our overall results. There are notable strengths, including robust data collection to assess the impact of the COVID-19 pandemic on a large number of measures regarding health and health care, living arrangements, lifestyle, and COVID-19 exposures and treatment. This survey was administered to a large number of older women residing across the United States, characterized by a diversity of rural and urban geographic locations.

### Table 4. COVID-19 Exposures, Testing, and Medical Care: Overall and by Rural/Urban Residence

|                                      | Overall (N = 49,695) | Rural Residence (N = 3,923) | Urban Residence (N = 45,640) | p Value |
|--------------------------------------|----------------------|-----------------------------|-------------------------------|---------|
| **Ever exposed to another person diagnosed or suspected of having COVID-19** |                      |                             |                               | .0825   |
| No, not that I know of               | 47,137 (96.2)        | 3,744 (96.9)                | 43,265 (96.2)                |         |
| Yes, someone outside of household    | 1,495 (3.1)          | 97 (2.5)                    | 1,396 (3.1)                  |         |
| Yes, someone living with me          | 346 (0.7)            | 23 (0.6)                    | 321 (0.7)                    |         |
| **Family member or close friend died of COVID-19** |                      |                             |                               | .0023   |
| No                                   | 46,524 (95.0)        | 3,721 (96.0)                | 42,679 (94.9)                |         |
| Yes                                  | 2,447 (5.0)          | 154 (4.0)                   | 2,287 (5.1)                  |         |
| **Tested for SARS-CoV-2**            |                      |                             |                               | .0003   |
| No                                   | 39,453 (80.5)        | 3,199 (82.5)                | 36,149 (80.4)                |         |
| Yes                                  | 9,241 (19.0)         | 646 (17.0)                  | 8,572 (19.1)                 |         |
| **If tested, test method**           |                      |                             |                               | .4283   |
| Nasal swab                           | 7,714 (86.6)         | 547 (87.7)                  | 7,150 (86.5)                 |         |
| Throat swab                          | 902 (10.1)           | 53 (8.5)                    | 845 (10.2)                   | .5906   |
| Saliva test                          | 281 (3.2)            | 22 (3.5)                    | 259 (3.1)                    | .0146   |
| Blood test                           | 1,139 (12.8)         | 60 (9.6)                    | 1,074 (13.0)                 |         |
| **If tested, number of times**       |                      |                             |                               | .0066   |
| 1                                    | 6,480 (71.9)         | 486 (77.4)                  | 5,977 (71.5)                 |         |
| 2                                    | 1,555 (17.1)         | 96 (15.3)                   | 1,454 (17.4)                 |         |
| 3 or more                            | 872 (9.7)            | 40 (6.4)                    | 831 (9.9)                    |         |
| Unsure                               | 104 (1.2)            | 6 (1.0)                     | 98 (1.2)                     |         |
| **If tested, positive test result**  |                      |                             |                               | .1279   |
| No                                   | 8,368 (94.0)         | 381 (93.3)                  | 7,766 (94.1)                 |         |
| Yes                                  | 311 (3.5)            | 19 (3.0)                    | 290 (3.5)                    |         |
| Unsure                               | 223 (2.5)            | 23 (3.7)                    | 200 (2.4)                    |         |
| **If positive result, which test(s) were positive** |                      |                             |                               | .8522   |
| Nasal swab                           | 222 (79.6)           | 13 (81.3)                   | 207 (79.3)                   | .5070   |
| Saliva test                          | 7 (2.5)              | 0 (0.0)                     | 7 (2.7)                      | .0995   |
| Throat swab                          | 22 (7.9)             | 3 (18.8)                    | 19 (7.3)                     | .1518   |
| Blood test                           | 57 (20.4)            | 1 (6.3)                     | 55 (21.1)                    |         |
| **Ever hospitalized for COVID-19**   |                      |                             |                               | .6938   |
| No                                   | 214 (71.6)           | 11 (64.7)                   | 202 (72.1)                   |         |
| Yes                                  | 81 (27.1)            | 6 (35.3)                    | 75 (26.8)                    |         |
| Unsure                               | 4 (1.3)              | 0 (0.0)                     | 3 (1.1)                      |         |

Notes: COVID-19 = coronavirus disease 2019; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2.

*The COVID-19 survey allowed participants to mark multiple responses to this question.*
In conclusion, results from this nationwide survey of older U.S. women in the WHI showed that the COVID-19 pandemic was associated with impacts on health and well-being, living situations, lifestyle, health care access, and SARS-CoV-2 testing and preventive behaviors. Data collected from this COVID-19 survey can be combined with the extensive database of time-varying WHI information on health, including prior longitudinal questionnaires, linkages with Medicare, the NDI, and the WHI biorepository to enable the investigation of innovative research questions on the short- and long-term health impacts of the pandemic. Furthermore, a readadministration of this COVID-19 survey in late 2021 will provide additional information on the longer term impact of the pandemic and opportunities for future research.

Supplementary Material

Supplementary data are available at The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences online.

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Conflict of Interest

None declared.

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