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## 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 (eg, 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/m<sup>2</sup>) 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  $\geq 0.06$  from most recent data collection) (18), lifetime depression (Burnam score  $\geq 0.06$  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 ( $\pm 5.6$ ) and had an average BMI of 26.1 kg/m<sup>2</sup> ( $\pm 5.2$ ). 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 ( $\pm 2.9$ ; 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

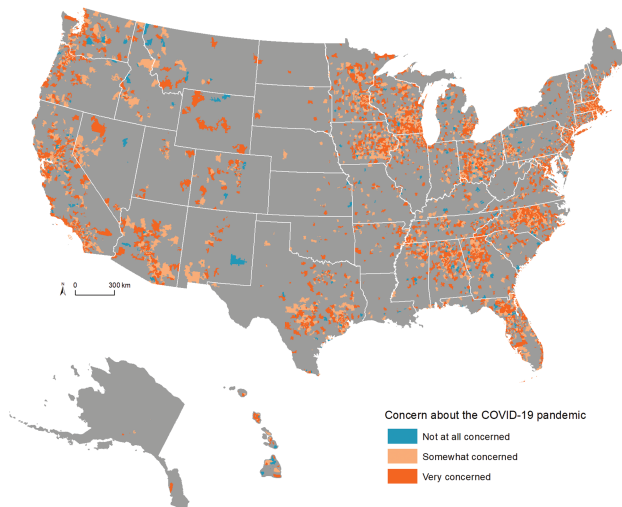
**Table 1.** Population Characteristics for WHI Participants: Overall and by Rural/Urban Residence

	Overall (N = 49 695)		Rural Residence (N = 3 923)		Urban Residence (N = 45 640)		Did Not Complete Survey (N = 14 655)		p Value
	N	%	N	%	N	%	N	%	
Age at survey completion (years), mean (SD)									
70–74	83.6	5.6	83.3	5.5	83.6	5.6	86.5	6.0	<.0001
75–79	993	2.0	81	2.1	907	2.0	167	1.1	<.0001
80–84	12 324	24.8	1 028	26.2	11 261	24.7	1 955	13.3	
85–89	16 083	32.4	1 284	32.7	14 754	32.3	3 518	24.0	
90–94	12 160	24.5	937	23.9	11 191	24.5	4 059	27.7	
≥95	6 445	13.0	484	12.3	5 949	13.0	3 540	24.2	
Body mass index at survey completion (kg/m <sup>2</sup> ), mean (SD)									
≥25	1 690	3.4	109	2.8	1 578	3.5	1 416	9.7	.0004
<25	26.1	5.2	26.5	5.3	26.0	5.2	25.9	5.6	
25–<30	23 154	47.8	1 669	43.5	21 437	48.2	5 735	50.1	<.0001
≥30	15 708	32.4	1 309	34.1	14 365	32.3	3 495	30.5	
≥30	9 564	19.7	859	22.4	8 680	19.5	2 214	19.3	
Ethnicity									
Non-Hispanic/Latina	48 151	96.9	3 878	98.9	44 159	96.8	14 030	95.7	
Hispanic/Latina	1 444	2.9	41	1.0	1 385	3.0	590	4.0	
Unknown/not reported	100	0.2	4	0.1	96	0.2	35	0.2	
Race									
American Indian/Alaska Native	106	0.2	22	0.6	83	0.2	40	0.3	<.0001
Asian	1 087	2.2	18	0.5	1 068	2.3	309	2.1	
Native Hawaiian/other Pacific Islander	35	0.1	3	0.1	32	0.1	18	0.1	
Black	2 792	5.6	72	1.8	2 711	5.9	1 538	10.5	
White	44 672	89.9	3 748	95.5	40 814	89.4	12 369	84.4	
More than 1 race	570	1.1	46	1.2	521	1.1	216	1.5	
Unknown/not reported	433	0.9	14	0.4	411	0.9	165	1.1	
Years of education									
Less than high school	920	1.9	79	2.0	839	1.9	598	4.1	<.0001
High school diploma or GED	6 680	13.5	678	17.4	5 988	13.2	2 551	17.5	
Some school after high school	17 244	34.9	1 530	39.2	15 662	34.6	5 496	37.7	
College degree or higher	24 513	49.7	1 615	41.4	22 835	50.4	5 922	40.7	
Month of survey completion*									
June	13 043	26.2	939	23.9	12 076	26.5			.0142
July	241	0.5	18	0.5	210	0.5			
August	26 862	54.1	2 207	56.3	24 612	53.9			
September	6 372	12.8	506	12.9	5 830	12.8			
October	3 177	6.4	253	6.4	2 912	6.4			
Survey mode									
Online	13 072	26.3	940	24.0	12 109	26.5			.0020
Paper	36 056	72.6	2 942	75.0	33 047	72.4			
Phone	567	1.1	41	1.0	484	1.1			
Region of residence									
Northeast	10 570	21.3	412	10.5	10 155	22.3			<.0001
Midwest	11 025	22.2	1 580	40.3	9 445	20.7			
South	13 374	27.0	1 051	26.8	12 323	27.0			
West	14 597	29.4	880	22.4	13 717	30.1			

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).





**Figure 1.** Concern regarding the COVID-19 pandemic among Women's Health Initiative (WHI) participants from March 2020 to October 2020. The mode survey response reported by WHI participants residing in each ZIP code is shown. COVID-19 = coronavirus disease 2019.

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 cancellations (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. Over 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

**Table 2.** Impact of the COVID-19 Pandemic on Well-being, Living Situations, Medications, and Health Care: Overall and by Rural/Urban Residence

	Overall (N = 49 695)		Rural Residence (N = 3 923)		Urban Residence (N = 45 640)		p Value
	N	%	N	%	N	%	
Current level of well-being							.6576
Excellent	4 915	10.0	390	10.0	4 512	10.0	
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							<.0001
Not at all concerned	3 245	6.8	297	7.8	2 937	6.7	
Somewhat concerned	20 247	42.2	1 726	45.5	18 454	41.8	
Very concerned	24 533	51.1	1 774	46.7	22 709	51.5	
Pandemic causing concerns about the following <sup>a</sup>							
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	5 339	11.7	<.0001
Getting adequate food	1 375	2.8	76	1.9	1 294	2.8	.0010
Getting enough exercise/physical activity	11 587	23.3	586	14.9	10 976	24.0	<.0001
Getting the sleep I need	3 813	7.7	224	5.7	3 578	7.8	<.0001
Having adequate housing	299	0.6	15	0.4	283	0.6	.0646
Having enough money to cover my needs	2 380	4.8	162	4.1	2 210	4.8	.0448
My personal safety	8 189	16.5	581	14.8	7 583	16.6	.0035
Health and safety of my family/friends	29 226	58.8	2 231	56.9	26 933	59.0	.0089
My financial security	3 795	7.6	235	6.0	3 547	7.8	<.0001
Financial security of my family	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	.8083
Perceived stress scale, mean (SD)	4.8	(2.9)	4.6	(2.9)	4.8	(2.9)	.0023
Living arrangement changed since March 2020 due to pandemic <sup>a</sup>	3 351	6.9	273	7.1	3 067	6.8	.6072
If yes, what changed							
Moved in with other family or friends	356	13.1	45	20.0	310	12.5	.0013
Family or friends moved in	495	18.2	41	18.2	454	18.3	.9881
Household members moved away	148	5.4	11	4.9	137	5.5	.6941
Moved out of shared housing	62	2.3	11	4.9	51	2.1	.0064
Care provider now comes to help	190	7.0	16	7.1	173	7.0	.9316
Care provider no longer comes to help	92	3.4	6	2.7	86	3.5	.5294
Moved into care facility	233	8.6	20	8.9	212	8.5	.8529
Moved out of care facility	61	2.2	8	3.6	53	2.1	.1679
Other changes	1 404	51.6	105	46.7	1 291	51.9	.1303
Steps taken since March 2020 to reduce risk of infection by COVID-19 <sup>a</sup>							
Washing hands frequently	45 019	90.6	3 564	90.8	41 335	90.6	.5625
Trying not to touch face	32 157	64.7	2 440	62.2	29 640	64.9	.0006
Disinfecting surfaces frequently	25 227	50.8	1 960	50.0	23 200	50.8	.2951
Maintaining physical distance from people outside household	44 344	89.2	3 431	87.5	40 809	89.4	.0001
Wearing a face mask in public	46 309	93.2	3 607	91.9	42 599	93.3	.0009
Wearing gloves in public	9 517	19.2	555	14.1	8 934	19.6	<.0001
Avoiding in-person social/religious activities	36 786	74.0	2 673	68.1	34 032	74.6	<.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
New actions taken to help family/friends/community during pandemic <sup>a</sup>							
Getting food or medicine for others	4 847	10.0	372	9.8	4 461	10.0	.6233
Providing childcare	979	2.0	91	2.4	888	2.0	.0962
Donating blood	768	1.6	81	2.1	686	1.5	.0054
Donating money	14 679	30.4	1 010	26.6	13 632	30.7	<.0001
Making masks for others	5 455	11.3	542	14.3	4 905	11.0	<.0001
Contacting friends/family to keep in touch	34 318	71.0	2 638	69.4	31 603	71.1	.0270
Other actions	1 933	4.0	141	3.7	1 789	4.0	.3411
No new actions	10 258	21.2	834	21.9	9 388	21.1	.2344
How often communicate with others outside home							.1133
Every day	22 819	47.8	1 743	46.3	21 030	48.0	
Several times per week	16 043	33.6	1 326	35.2	14 663	33.4	
1–2 times per week	5 326	11.2	404	10.7	4 906	11.2	
Once per week	1 945	4.1	155	4.1	1 784	4.1	
Rarely or never	1 607	3.4	140	3.7	1 462	3.3	

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

<sup>a</sup>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	%	N	%	
In past 3 months, average number of alcoholic drinks							<.0001
None	25 600	52.2	2 168	56.1	23 356	51.9	
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	.8355
Over past month, level of physical activity or exercise compared to average before pandemic							<.0001
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							.6021
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	24.5	
7 or more times per week	9 038	18.5	683	17.8	8 333	18.6	

Notes: COVID-19 = coronavirus disease 2019.

care access, which included delays in getting prescriptions filled and health care appointment conversions to telephone or online (the latter more commonly reported among urban residents). There were notable changes in lifestyle factors; for example, over half of women reported less physical activity or exercise compared to before the pandemic, which was more commonly reported among women residing in urban areas. A lower proportion of women reported consuming alcohol compared to reports from prior to the COVID-19 pandemic. Although the prevalence of SARS-CoV-2 infection was low in this study population, some observed trends included a higher proportion of respondents reporting having tested for SARS-CoV-2 in the fall compared to the summer. To the best of our knowledge, this survey represents one of the first to describe the impact of the pandemic among a large cohort of United States older women.

Overall, WHI participants reported generally high levels of current well-being from March 2020 to October 2020 irrespective of geography. These women also experienced low levels of perceived stress, a measure of control and coping (17). Older adults generally have better emotional regulation and positive affective experience compared to younger adults (21). There is also evidence showing that older adults may be less affected by mental health outcomes compared to younger adults during the pandemic, with lower rates of anxiety disorder, depressive disorder, or trauma- or stress-related disorder, substance abuse, and suicidal ideation among individuals aged 65 years or older (22). Older adults are also more likely to be resilient and have higher levels of wisdom (23–25), which has been associated with adapting to encountered circumstances, accelerating recovery, and mitigating the negative impacts of a crisis (26). Studies conducted in other countries during the pandemic, including Spain and Canada, have shown that older age ≥60 years was associated with lower rates of depression, anxiety, posttraumatic stress disorder, and less reactivity to stressors (27,28). Social support has also been associated with a protective association with psychological distress and loneliness (26). This is consistent with our finding that a large proportion of WHI participants communicated and engaged with

their community, family, and friends during the pandemic, including reports of engaging in new activities such as philanthropy. However, there was a slight decrease in the proportion of women reporting high levels of current well-being in Fall 2020 compared to Summer 2020, potentially due to the long-term effects of social isolation (29). Furthermore, a large proportion of respondents reported being very concerned about the pandemic (especially in urban areas), including concern regarding risk of themselves and/or their family and friends being infected with SARS-CoV-2 (which remained high over time). Further research into the long-term changes in mental health and well-being associated with prolonged disruptions due to the pandemic are warranted.

Testing for SARS-CoV-2 (mostly using nasal swabs) increased over time, although the positivity rate in this study population was low (3.5%). A small proportion of participants reported exposure to another person diagnosed or suspected of having COVID-19. This is consistent with the high rates of participants adopting preventive behaviors to reduce risk of infection, including wearing a face mask, washing their hands, social distancing, and/or staying at home. However, there was a slight decline in the proportion of participants engaging in preventive measures in the fall compared to the summer. Furthermore, in rural areas compared to urban areas, women were less likely to have avoided in-person social/religious activities. Research has shown that rural residents may be less likely to engage in social distancing measures and to wear a face mask during the pandemic (30–32).

Although the majority of participants resided in a private home, there were reported disruptions in living arrangements due to the pandemic, which differed by geography and over time. Rural compared to urban participants, as well as respondents to the survey in the fall compared to the summer, were more likely to report moving in with other family or friends. In the fall compared to summer, women in the Northeast and West were more likely to report having their care provider now coming to help, while women in the Midwest and South were more likely to report



**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
	N	%	N	%	N	%	
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	18.9	646	16.7	8 572	19.1	
Unsure	287	0.6	31	0.8	256	0.6	
If tested, test method*							.4283
Nasal swab	7 714	86.6	547	87.7	7 150	86.5	.1658
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	17.3	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	581	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.

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.

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 readministration 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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