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

Relationship of Social Connectedness With Decreasing Physical Activity During the COVID-19 Pandemic Among Older Women Participating in the Women’s Health Initiative Study

Carolyn J. Crandall, MD, MS, MACP;* Joseph Larson, MS; Crystal Wiley Cene, MD, MPF, FAHA, PhD; John Bellettiere, PhD, MPH, MA; Deepika Laddu, PhD; Rebecca D. Jackson, MD; Benjamin T. Schumacher, PhD (c), MPH; and Marcia L. Stefanick, PhD; the Women’s Health Initiative Investigators

*Address correspondence to: Carolyn J. Crandall, MD, MS, MACP, Division of General Internal Medicine and Health Services Research, David Geffen School of Medicine at University of California, Los Angeles, California, USA.

Abstract

Background: Aging is generally accompanied by decreasing physical activity (PA), which is associated with a decline in many health parameters, leading to recommendations for older adults to increase or at least maintain PA.

Methods: We determined relationships between social connectedness and decreasing or increasing PA levels during the coronavirus disease 2019 pandemic among 41,443 participants of the Women’s Health Initiative Extension Study. Outcomes of logistic regression models were decreasing PA activity (reference: maintaining or increasing) and increasing PA activity (reference: maintaining or decreasing). The main predictor was social connectedness as a combined variable: not living alone (reference: living alone) and communicating with others outside the home more than once/week (reference: once/week or less). We adjusted for age, race, ethnicity, body mass index, physical function level, and education.

Results: Compared with participants who were not socially connected, socially connected participants had lower odds of decreasing PA (adjusted odds ratio 0.91, 95% confidence interval 0.87–0.95). Odds of increasing PA (vs decreasing or maintaining PA) were not significantly different among socially connected and not socially connected participants. Associations between social connectedness and decreasing PA did not significantly differ by age (<85 vs ≥85 years), race/ethnicity (non-Hispanic White vs other races/ethnicity), education (college vs <college), use of technology to stay in touch with others, or Research and Development physical function score (≤75 vs >75).

Conclusion: Social connectedness was associated with lower odds of decreasing PA among older women during the pandemic. These findings could inform the development of future interventions to help older women avoid decreasing PA.
Well-documented benefits of physical activity (PA) include reduced risk of heart disease, hypertension, stroke, several cancers, including breast and colorectal cancer; diabetes; falls; and premature death, as well as improved sleep, balance, and joint mobility (1–4). Given these benefits, and recognizing the aging of the U.S. population (5,6), it is particularly important to ensure adequate PA among older persons. Concerns about a decrease in PA levels during the coronavirus disease 2019 (COVID-19) pandemic (7,8) are of major public health importance, considering that the majority of U.S. adults were not obtaining recommended levels of PA even before the pandemic, with fewer than 20% of women aged 65 years and older engaging in sufficient PA (1,2).

The pandemic also posed challenges to maintaining social connectedness (eg, social isolation, network size, social integration, and social support), which could also adversely influence health outcomes; social isolation is associated with increased risk of death (9). Also, among women aged between 65 and 99, social isolation and loneliness have each been independently associated with a higher risk of cardiovascular disease (10). Findings from an online survey conducted in April 2020 of over 1,000 North American adults aged 50 and older suggested that even light PA during the COVID-19 pandemic may have alleviated some of the negative mental health affects that older adults were experiencing while isolated and adhering to social distancing guidelines (11). A Scottish survey (mean participant age 32 years) similarly found that less PA was associated with greater negative mood (12). How social connectedness influences PA levels public health crises that mandate social distancing, such as the COVID-19 pandemic, is important to understand. While lack of social support during the COVID-19 was reported as a reason for not doing PA among adults in Denmark (13), and staying in touch with family and friends and staying active were each rated as top priorities in the midst of the COVID-19 pandemic in a subset of older women assigned to a PA intervention in a randomized controlled trial (14,15), one U.S. study found no association of social support with PA during the pandemic (16). To the best of our knowledge, no published studies have ascertained whether social connectedness would be associated with lower odds of decreasing PA level but would not be significantly associated with increasing PA level during the COVID-19 pandemic.

Method

Women’s Health Initiative Study Design

Between 1993 and 1998, 161,808 postmenopausal women aged 50–79 years were enrolled in the Women’s Health Initiative (WHI) at 40 clinical sites. The WHI consisted of the randomized clinical trials, which tested 3 interventions (menopausal hormone therapy, calcium plus vitamin D supplementation, and/or low-fat dietary pattern intervention), and the WHI Observational Study, which was designed to determine important causes of morbidity and mortality among postmenopausal women (18). Women with less than 3 years of predicted survival or who planned to move within 3 years were excluded from participating, with additional exclusions for each clinical trial. After the clinical trial and observational study phase were completed (1993–2005), all active study participants were invited to continue participating for 5 years at their respective clinical centers (2005–2010), after which those who were still actively participating were invited to continue ongoing follow-up in the WHI Extension Study (2010–present). Each participant provided written informed consent to participate. The WHI Extension Study includes a substudy, the Women’s Health Initiative Strong and Healthy (WHISH) trial, which is testing whether increasing PA will reduce heart disease and stroke in older women. Institutional review board approval was obtained by the institutions affiliated with 4 WHI regional centers and/or the WHI Coordinating Center at the Fred Hutchinson Cancer Research Center, which assumed the role of IRB of record for each participant.

In 2020, all participants who were alive and had consented to be contacted by WHI (n = 64,350) were invited to complete the WHI COVID-19 survey which included items about self-rated well-being, medical history (high blood pressure, diabetes, cancer, and autoimmune disease), change in living arrangement, number of people living in the household, access to visitors, restriction of

Keywords: COVID-19, Social connectedness, Social isolation, Physical activity

![Figure 1](https://doi.org/10.17226/25663)
exit and entry to the home, exposure to persons suspected of being COVID-19 infected, death of family or close friends due to COVID-19, COVID-related symptoms, COVID-19 testing (frequency, nasal swab, throat swab, saliva test, blood test, and test results), hospital stays or treatments for COVID-19, access to medication and health care utilization during the pandemic, degree of concern regarding the pandemic, type and frequency of communication with others outside the home, the use of technology to stay in touch with others, alcohol use, smoking, and PA. The COVID-19 survey included the items from the Perceived Stress Scale and the Patient-Reported Outcomes Measurement Information System Emotional Distress-Anxiety Short Form 4 (PROMIS) scale (https://www.healthmeasures.net/explore-measurement-systems/promis/intro-to-promis/list-of-adult-measures). Also, the questionnaire include an item asking “Has anyone in your family or a close friend died from COVID-19?” Response choices were “no” and “yes.”

Of the 64,350 participants eligible to receive the COVID-19 survey, 49,695 (77.2%) participants completed the survey (Figure 2). We excluded data from participants who reported ever having had a positive COVID test (n = 311), those who did not provide data regarding the change in PA during versus before the pandemic (main outcome) or social connectedness (main predictor; n = 6,651), and women for whom information regarding covariates were missing (1,290), resulting in an analytic sample of 41,443 participants.

Assessment of PA Before Versus During the COVID-19 Pandemic
On the COVID-19 questionnaire, participants were asked, “Over the past month, how would you describe your level of PA or exercise compared to your average PA level before the COVID-19 pandemic began?” Response choices included: “much less,” “somewhat less,” “about the same,” “somewhat more,” and “much more.” We defined maintaining PA as “about the same.” For the statistical analyses, we created 2 binary (yes/no) outcome variables. The first variable was decreased PA (“much less” or “somewhat less” vs “about the same,” “somewhat more,” or “much more”). The second variable was increased PA (“somewhat more” or “much more” vs “much less,” somewhat less,” or “about the same”).

Assessment of Social Connectedness
Regarding living alone, participants were asked, “How often do you communicate with others who live outside your home?” The responses choices were: “every day,” “several X/week,” “1–2 X/week,” “once/week,” or “rarely/never.” For statistical analyses, we collapsed the categories into a binary (yes/no) variable: more than once per week (“once/week,” “1–2 X/week,” “several X/week,” or “every day”) versus once per week or less (“rarely/never,” “once/week”). In addition, participants were asked “compared to the months before the outbreak began, would you say that this is …: “more often than before,” “about the same as before,” or “less often than before.”

Other Covariates
At baseline, we used a self-assessment questionnaire for information regarding age, race, ethnicity, smoking, and highest education attained. On annual questionnaires, as well as on the COVID-19 survey, participants updated their medical history, including information regarding cardiovascular disease, peripheral artery disease, cancer, diabetes, and hypertension.

From annual questionnaires, we accessed information regarding the physical function and body mass index (BMI). For each participant, we used data from the most recently-collected survey data (within the last 2 years) prior to the COVID-19 survey. Physical function was assessed using the Research and Development (RAND) 36-item health survey physical functioning construct (range 0–100, higher score indicates more favorable health state) (19–21). Physical function score was categorized as <65, 65–75, 76–89, or ≥90. Body weight was self-reported by participants on questionnaires administered in 2018; if the 2018 information regarding body weight was missing, information from 2013 to 2014 questionnaire was used. At the baseline WHI visit, the height of participants were measured by trained research staff. BMI was calculated as weight in kilograms divided by height in meters squared. A subset of participants (n = 26,847 participating in the WHISH trial), received the CHAMPS PA questionnaire, including information about hours per week of PA prior to the pandemic (prior to March 13, 2020) (22).

Statistical Analysis
We used logistic regression to determine associations between social connectedness (primary predictor) and decreasing PA (reference: not decreasing PA) during versus before the COVID-19 pandemic (primary outcome). The secondary prespecified outcome, examined in a separate logistic regression model, was increasing PA (reference: not increasing) during versus before the COVID-19 pandemic.
We adjusted the logistic regression models for potential moderators (age and education) as well as potential confounders selected a priori: BMI and physical function level prior to COVID-19 pandemic, race, and ethnicity. All models were adjusted for Women's Health Initiative Study component (clinical trial and observational study) and WHISH trial intervention assignment (intervention, control, and not randomized). In the subset of participants who provided information regarding hours per week of PA prior to the pandemic (n = 26,847), we performed a sensitivity analysis in which we repeated the main analysis described earlier before and after adjustment for tertile of hours per week of PA prior to the pandemic. In another sensitivity analysis, we repeated the logistic regression models using maintained PA as the reference group. Specifically, we compared decreased (vs maintained PA) and increased (vs maintained PA).

To test the hypothesis that associations between social connectedness and PA during (vs before) the COVID-19 pandemic differed based on characteristics selected a priori, we used statistical interaction terms (social connectedness × characteristic). In this way, we tested for effect modification by age (<85 vs ≥85 years), education (no <high school vs ≥college), race and ethnicity (Non-Hispanic White vs all other race and ethnicities), using technology to stay in touch with others (yes vs no), physical function score (RAND 36-item health survey physical functioning score ≤75 vs >75), and change in the frequency of communication with others outside the household during (compared with before) the pandemic.

Results

Characteristics of the Study Participants

Sociodemographic and clinical characteristics of the study participants are presented in Table 1. Mean (standard deviation [SD]) participant age was 83.2 (5.4) years; mean (SD) BMI was 26.1 (5.2). Of the total group of 41,443 women, 15,679 women (38%) were aged 85 years and older. The majority of participants reported being White (n = 37,469, 90%) and non-Hispanic (40,215, 97%) with 465 participants identifying with more than one racial group. Forty-seven percent of participants reported living alone and 7% of participants reported communicating with others outside the home once per week or less.

Of the 41,443 participants, 20,092 participants (48%) were socially connected (reported communicating with others outside the household more than once per week and were not living alone); 21,351 (52%) were not socially connected. Compared with women who were not socially connected, characteristics of those who were socially connected were similar. Socially connected women were more likely to have a high RAND physical function score (29% vs 24% had score ≥90) and rate their well-being as excellent (53% vs 48%); they were less likely to stay in touch with others by speaking in person (37% vs 42%).

Characteristics of participants by level of PA during versus before COVID-19 are provided in Supplementary Table 1 (by 2 PA categories: maintained or increased vs decreased PA) and Supplementary Table 2 (by 3 PA categories: maintained, decreased, and increased). Of the 41,443 participants, 22,547 (54%) reported that their PA during the COVID-19 was less than before the pandemic; 15,332 (37%) reported that their PA during the pandemic was the same as before the pandemic, and 3,564 (9%) reported PA during the pandemic being more than before the pandemic. Women who reported decreasing PA were less likely to have high physical function scores, less likely to report excellent/very good well-being, and more likely to report being very concerned about the COVID-19 pandemic.

Associations Between Frequency of Communication With People Outside the Household and PA Levels: Results of Logistic Regression Models

We present the results of 2 sets of models for the 2 prespecified outcomes: decreased PA (primary outcome) and increased PA (secondary outcome; Table 2). Compared with women who were not socially connected, in unadjusted models, women who were socially connected had significantly lower odds of decreasing their PA levels during the COVID-19 pandemic (odds ratio [OR] 0.90, 95% confidence interval [CI] 0.87–0.94). These findings persisted in fully adjusted models, with an OR of 0.91 (95% CI 0.87–0.95) after adjustment for age, race, ethnicity, BMI, physical function level, education, and WHI study component arm.

Results of Interaction Tests

Associations between social connectedness and decreased PA during versus before the COVID-19 pandemic did not significantly differ by age (85 years-old or older vs younger than 85 years-old), race and ethnicity (non-Hispanic White vs all other race and ethnicities), education (college graduate yes vs no), physical function level prior to the pandemic (RAND physical function score ≤75 vs >75), use of technology to stay in touch with others (women who did not use technology vs women who did use technology), and change in frequency of communication with others outside the household during (compared with before) the COVID-19 pandemic (all interaction p values > .05; Table 3).

Discussion

In this large cohort of older women from across the United States, women who were socially connected were significantly less likely to decrease their PA levels during the COVID-19 pandemic than women who did not socially connecte. These associations between social connectedness and decreasing PA were similar among women aged 85 years and older versus <85 years-old, women who had lower versus higher prepandemic physical function score, women who reported being college graduates versus not being college graduates, and using versus not using technology to stay in touch with others. We had hypothesized a priori that social connectedness would be associated with increased or maintained PA during the pandemic. Our findings were consistent with the prespecified hypothesis.

We cannot directly compare our results with those of previous similar studies. To the best of our knowledge, studies have not directly assessed whether the indicators of social connectedness that we examined are associated with the odds of decreasing PA in...
Table 1. Sociodemographic and Clinical Characteristics of the Study Population by Social Connectedness*

| Characteristic                                      | All Participants (n = 41,443) | Socially Connected |
|----------------------------------------------------|-------------------------------|--------------------|
|                                                    | n   | %    | n   | %    | n   | %    | p Value† |
| Age, mean (SD) years                               | 83.2 (5.4) | 84.1 (5.5) | 82.2 (5.2) | <.001 |
| <80                                                | 11,916 (28.8) | 4,938 (23.1) | 6,978 (34.7) |  |
| 80–84                                              | 13,848 (33.4) | 6,794 (31.8) | 7,054 (35.1) |  |
| ≥85                                                | 15,679 (37.8) | 9,619 (45.1) | 6,060 (30.2) |  |
| Race                                               | .003 |
| American Indian/Alaska Native                      | 86 (0.2) | 51 (0.2) | 35 (0.2) |  |
| Asian                                              | 938 (2.3) | 431 (2.0) | 507 (2.5) |  |
| Native Hawaiian/Pacific Islander                   | 34 (0.1) | 17 (0.1) | 17 (0.1) |  |
| Black/African American                             | 2,118 (5.1) | 1,117 (5.2) | 1,001 (5.0) |  |
| White                                              | 37,469 (90.4) | 19,352 (90.6) | 18,117 (90.2) |  |
| More than one race†                                 | 465 (1.1) | 217 (1.0) | 248 (1.2) |  |
| Unknown/not reported                               | 333 (0.8) | 166 (0.8) | 167 (0.8) |  |
| Ethnicity                                          | .05 |
| Hispanic/Latina                                    | 1,146 (2.8) | 150 (4.5) | 554 (2.6) |  |
| More than one race†                                 | 465 (1.1) | 217 (1.0) | 248 (1.2) |  |
| Unknown/not reported                               | 333 (0.8) | 166 (0.8) | 167 (0.8) |  |
| Education                                          | <.001 |
| ≤High school/general equivalency diploma           | 6,107 (14.7) | 3,284 (15.4) | 2,823 (14.1) |  |
| School after high school                           | 14,283 (34.5) | 7,414 (34.7) | 6,869 (34.2) |  |
| ≥College degree                                    | 21,053 (50.8) | 10,635 (49.9) | 10,400 (51.8) |  |
| Physical function score,‡ mean (SD)                | 65.1 (26.9) | 63.4 (27.0) | 66.9 (26.7) | <.001 |
| Smoking                                            | <.001 |
| Never                                              | 21,925 (52.9) | 11,000 (51.5) | 10,925 (54.4) |  |
| Past                                               | 19,006 (45.9) | 10,045 (47.0) | 8,961 (44.6) |  |
| Current                                            | 512 (1.2) | 306 (1.4) | 206 (1.0) |  |
| Perceived Stress Scale score, mean (SD)§           | 50.8 (8.3) | 50.8 (8.4) | 50.8 (8.2) | <.001 |
| Medical history‡                                    | .75 |
| Cardiovascular disease                             | 4,953 (12.0) | 2,737 (12.8) | 2,216 (11.0) | <.001 |
| Myocardial infarction                              | 1,810 (4.4) | 1,019 (4.8) | 791 (3.9) | <.001 |
| Coronary artery bypass graft/percutaneous transluminal coronary angioplasty | 2,626 (6.3) | 1,442 (6.8) | 1,184 (5.9) | <.001 |
| Stroke                                             | 1,966 (4.7) | 1,102 (5.2) | 864 (4.3) | <.001 |
| Peripheral artery disease                          | 631 (1.5) | 362 (1.7) | 269 (1.3) | .003 |
| Cancer                                             | 10,744 (25.9) | 5,682 (26.6) | 5,062 (25.2) | <.001 |
| Treated diabetes                                    | 8,620 (20.8) | 4,483 (21.0) | 4,137 (20.6) | .31 |
| Treated hypertension                               | 29,568 (71.3) | 15,509 (72.6) | 14,059 (70.0) | <.001 |
| Self-rated current level of well-being              | <.001 |
| Excellent/very good                                | 20,799 (50.2) | 10,201 (47.8) | 10,598 (52.7) |  |
| Good                                               | 15,032 (36.3) | 8,058 (37.7) | 6,974 (34.7) |  |
| Fair/poor/very poor                                | 5,345 (12.9) | 2,937 (13.8) | 2,408 (12.0) |  |
| Number of people living in household                | <.001 |
| 1                                                  | 19,432 (46.9) | 19,432 (91.0) | 0 (0) |  |
| 2                                                  | 17,567 (42.4) | 1,221 (5.7) | 16,346 (81.4) |  |
| ≥3                                                 | 4,444 (10.7) | 698 (3.3) | 3,746 (18.6) |  |
older women during the COVID-19 pandemic in the United States. However, our results are generally consistent with published studies of PA during the pandemic, such as, living with smaller number of persons in the household was associated with “unhealthy lifestyle” (composite of PA, nutritional components, and other features) among adults in Spain (23), that anxiety negatively influenced the intention to do PA among adults in Italy (24), that living alone was significantly related to declines in PA among adults in the United States (25), that more social support was associated with higher moderate-vigorous PA among adolescents in the United States (26), that greater social media use (Facebook, Facebook Messenger, Instagram, WhatsApp, and TikTok) is related to higher step count (assessed via smartphone application) among adult psychiatric out-patients in Spain (27), greater social support was associated with PA during the pandemic among student athletes (28), and that higher social support is associated with better self-reported health behavior among hospitalized patients in Thailand (29). Our findings are also consistent with studies reporting that no longer meeting PA guidelines during the COVID-19 pandemic was associated with loneliness among U.S. adults (30).

However, results of one study suggested that greater social support was not significantly associated with PA during the pandemic among U.S. adults (not specific to older persons) (16) and another study performed in Denmark found that the largest decline in minutes per week of PA during the COVID-19 pandemic occurred among adults who lived with their parents (40% decline), and the smallest decline in PA occurred among persons living alone (8% decline) (13). However, neither of the latter 2 studies specifically focused on older women.

While the majority of results of previously-published studies are consistent with the results and hypothesis of the current study, they are not necessarily representative of the general population of older women in the United States, because they examined participants residing outside of the United States ((13,23,24,27–29), focused on special populations such as adolescents or teenagers (26,28), psychiatric outpatients (27), hospitalized patients (29), and/or did not

Table 1. Continued

| Characteristic                                                                 | All Participants (n = 41,443) | Socially Connected |
|-------------------------------------------------------------------------------|------------------------------|--------------------|
| Friend or family member who had died from COVID-19                            | 2,068 (5.0)                 | 1,022 (4.8)        |
| Concern about the COVID-19 pandemic                                          |                              |                    |
| Not at all concerned                                                         | 2,546 (6.1)                 | 1,371 (6.4)        |
| Somewhat concerned                                                           | 17,276 (41.7)               | 8,993 (42.1)       |
| Very concerned                                                               | 21,101 (50.9)               | 10,684 (50.0)      |
| Frequency of communication with others outside the home                      |                              |                    |
| Every day                                                                    | 19,924 (48.1)               | 10,851 (50.8)      |
| Several times per week                                                       | 14,129 (34.1)               | 5,913 (27.7)       |
| 1–2 times per week                                                           | 4,513 (10.9)                | 1,710 (8.0)        |
| Once per week                                                                | 1,629 (3.9)                 | 1,629 (7.6)        |
| Rarely or never                                                              | 1,248 (3.0)                 | 1,248 (5.8)        |
| Change in frequency of communication with others outside the home compared with before the COVID-19 pandemic |                              |                    |
| More often                                                                   | 6,384 (15.4)                | 3,465 (16.2)       |
| About the same                                                               | 23,442 (56.6)               | 11,953 (56.0)      |
| Less often                                                                   | 10,995 (26.5)               | 5,572 (26.1)       |
| Methods of staying in touch with others                                       |                              |                    |
| Speaking in person                                                           | 16,435 (39.7)               | 9,031 (42.3)       |
| Telephone                                                                    | 40,058 (96.7)               | 20,630 (96.6)      |
| Technology*                                                                  | 30,910 (74.6)               | 15,080 (70.6)      |
| Postal mail                                                                  | 13,358 (32.2)               | 6,847 (32.1)       |
| Level of physical activity in past month compared with prior to COVID-19 pandemic |                              |                    |
| Much less                                                                    | 10,524 (25.4)               | 5,746 (26.9)       |
| Somewhat less                                                                | 12,023 (29.0)               | 6,127 (28.7)       |
| About the same                                                               | 15,332 (37.0)               | 7,756 (36.3)       |
| Somewhat more                                                                | 2,830 (6.8)                 | 1,337 (6.4)        |
| Much more                                                                    | 734 (1.8)                   | 365 (1.7)          |

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

*Social connectedness defined as living with at least one other person and communicating with others outside the household at least once per week.

†p Value comparing characteristic by social connectedness based on t tests for continuous variables and chi-square tests for categorical variables.

‡RAND 36-item health survey physical functioning construct (range 0–100). Higher score is more favorable.

§Range 0–16 (4 questions with responses each scored 0–4). Higher score indicates greater stress.

‖Patient-Reported Outcomes Measurement Information System Emotional Distress-Anxiety Short Form 4.

¶Collected at study enrollment as well as throughout study follow-up period.

#Video calls, email, or social media.
Finally, results of one study suggested that greater social support was associated with PA during the pandemic among student athletes (not specific to older persons) (28).

In the broader context of interventions that have been tested to increase PA among older women, The 2018 Physical Activity Guidelines Advisory Committee Scientific Report for the Secretary of U.S. Health and Human Services found that, among older adults, the effectiveness of interventions to increase PA were consistently positive, but the magnitude of the effect was not easy to determine (https://health.gov/our-work/physical-activity/current-guidelines/scientific-report). Indeed, the limited number of studies without an

### Table 2. Decreasing (vs Maintaining or Increasing) Physical Activity and Increasing (vs Decreasing) Physical Activity during Pandemic by Social Connectedness*

| Social Connectedness | Yes (n = 20 092) | No (n = 21 351) | p Value |
|----------------------|------------------|-----------------|---------|
| Decreased physical activity,† n (%) | 10 674 (53.1) | 11 873 (55.6) | < .001 |
| Models | OR (95% CI) | OR (95% CI) | < .001 |
| Unadjusted | 0.90 (0.87, 0.94) | 1.00 (ref) |
| Age/ethnicity/race-adjusted | 0.91 (0.87, 0.95) | 1.00 (ref) |
| Multivariate adjusted‡ | 0.91 (0.87, 0.95) | 1.00 (ref) |
| Increased physical activity,‖ n (%) | 1 842 (9.2) | 1 722 (8.1) | .87 |
| Models | OR (95% CI) | OR (95% CI) | .87 |
| Unadjusted | 1.15 (1.07, 1.23) | 1.00 (ref) |
| Age/ethnicity/race-adjusted | 1.01 (0.94, 1.08) | 1.00 (ref) |
| Multivariate adjusted‡ | 0.99 (0.93, 1.07) | 1.00 (ref) |

Notes: OR = odds ratio; SD = standard deviation.

*Odds ratios, corresponding confidence intervals, and p values are from a logistic regression model with physical activity outcome (yes/no) as a function of social connectedness (yes/no) defined as not living alone and having communication outside the household more than once per week. All models adjusted for Women’s Health Initiative component (clinical trial and observational study) and Women’s Health Initiative Strong and Healthy Trial intervention assignment (intervention, control, and not randomized).

†Decreased (vs maintained or increased).
‡Multivariate models are additionally adjusted for body mass index, physical function, and education.
‖Increased (vs maintained or decreased).

### Table 3. Decreasing Physical Activity in Pandemic by Social Connectedness, by Subgroups

| Subgroup | Total n | Decreased Physical Activity, n (%) | Socially Connected Versus Not, Odds Ratio (ref)* | Interaction p Value |
|----------|---------|-----------------------------------|-----------------------------------------------|--------------------|
| All participants | 41 443 | 22 547 (54.4%) | 0.91 (0.87, 0.95) | .24 |
| Age, years | | | | |
| <85 | 25 764 | 13 940 (54.1%) | 0.93 (0.88, 0.97) | .54 |
| ≥85 | 15 679 | 8 607 (54.9%) | 0.88 (0.83, 0.94) | .60 |
| Education | | | | |
| ≤School after high school | 20 390 | 10 526 (51.6%) | 0.90 (0.85, 0.95) | .55 |
| College graduate | 21 053 | 12 021 (57.1%) | 0.92 (0.87, 0.97) | |
| Technology use to stay in touch with others† | | | | |
| Yes | 30 910 | 17 254 (55.8%) | 0.89 (0.85, 0.93) | .06 |
| No | 10 412 | 5 231 (50.2%) | 0.91 (0.84, 0.99) | |
| Race/ethnicity | | | | |
| Non-Hispanic White | 36 653 | 19 679 (53.7%) | 0.91 (0.87, 0.95) | |
| All other race/ethnicities‡ | 4 790 | 2 868 (59.9%) | 0.88 (0.78, 0.99) | |
| Physical function score (RAND 36-item health survey physical functioning construct) | | | | |
| ≤75 | 24 125 | 13 891 (57.6%) | 0.88 (0.84, 0.93) | 1.19 |
| >75 | 17 318 | 8 656 (50.0%) | 0.95 (0.90, 1.01) | |
| Change in frequency of communication during (compared with before) the COVID-19 pandemic | | | | |
| More often/same | 29 826 | 15 101 (50.6%) | 0.92 (0.88, 0.96) | |
| Less | 10 995 | 7 125 (64.8%) | 0.86 (0.80, 0.94) | |

Note: BMI = body mass index; COVID-19 = coronavirus disease 2019; WHI = Women’s Health Initiative.

*Odds ratios, corresponding confidence intervals, and interaction p values are from a logistic regression model with decreasing physical activity (yes/no) as a function of social connectedness (yes/no), the subgroup of interest, and their interaction, adjusted for WHI component (clinical trial and observational study), age, ethnicity, race, BMI, physical function, and education.
†Video calls, email, or social media.
‡Includes participants with unknown race and/or ethnicity.

not provide results specific to older women (13,16,23–25,27,29). Finally, results of one study suggested that greater social support was associated with PA during the pandemic among student athletes (not specific to older persons) (28).
active control group and the diverse range of PA outcomes precludes the use of meta-analysis to provide a summary of intervention effectiveness. One systematic review reported that interventions had a small effect on PA (Cohen’s $d = 0.14$, 95% CI 0.09–0.20), with effect sizes ranging from $d = -0.02$ to $d = 0.63$ (31, PMID 24648017). This led the Physical Activity Guidelines Advisory Committee Scientific Report to conclude that “strong evidence demonstrates that PA interventions that target older adults have a small but positive effect on PA when compared with minimal or no-treatment controls.”

Our results have public health relevance. Decreasing PA during the COVID-19 pandemic has been associated with higher depression, anxiety, and stress symptoms (Australian survey (32)), and people who exercised more during the pandemic had higher psychological resilience (cross-sectional U.S. survey) (33). Among identical twins in the United States, a decrease in PA during the pandemic was associated with higher anxiety levels (34). If acute changes to behavior, such as decreased PA, are sustained for longer periods of time, they could be associated with a higher risk for conditions linked with low PA, such as cardiovascular disease and diabetes.

It is difficult to ascertain cause and effect in these associations. Anxiety may have caused a decrease in PA, but the decrease in PA may have caused anxiety. For example, a study of persons in Norway aged 18–81 years found that reduced PA during the COVID-19 lockdown was associated with a higher risk of anxiety and depression (35). The safety of PA outdoors might be influenced by where someone lives. Also, the pandemic may increase sedentary behavior (which may have its own relationships with social connectedness) along with decreases in PA. Finally, the potential dependence of using devices to communicate with others outside the household may be a surrogate for greater wealth (allowing the purchase of electronic devices).

Our study has several potential limitations. We only had information regarding hours per week of prepandemic PA levels in a subset of participants (26,847 of 41,443 participants). Second, we did not have information regarding the potential influence of COVID-19 mitigation strategies on the use of certain venues for PA among our study participants, which could in part explain our results. Third, we did not have information regarding social network size, social integration, loneliness, or relationship quality. Finally, we lacked recent information regarding social support and marital status, although we were able to focus on the number of people living in the household. Results of this study cannot be generalized to social connectedness and PA during nonpandemic times, as the current study was designed specifically to evaluate PA during the COVID-19 pandemic. However, our results may apply to circumstances that result from other types of public health emergencies.

Strengths of our study include the large number of participants, the detailed information regarding covariates including physical function and technology use, and the racial/ethnic diversity of the study cohort. In addition, we use a temporally-anchored self-report of PA for analyses regarding the change of activity prior to and during the pandemic in relation to social connectedness. Our results are consistent regardless of whether the comparator was defined as women who maintained PA or defined as women who did not increase (or decrease) PA, that is, when the reference was maintained or increased, or maintained or decreased, PA. This consistency further supports our hypothesis that older women who had greater social connectedness would be less likely to decrease their PA during the COVID-19 pandemic.

In conclusion, these findings provide insights into the potential importance of maintaining communication with others outside the household and not living alone in efforts to avoid decreases in PA among older women during future local and national crisis periods, and could inform the development of future interventions designed to help older women avoid decreasing PA more generally.

**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**

J.B. receives funding from the Facebook Health Team. The other authors declare no conflict.

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**Short List of WHI Investigators**

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**Author Contributions**

Concept and design: M.L.S., C.J.C., and J.L. Acquisition, analysis, or interpretation of data: all authors. Drafting of the manuscript: C.J.C. and M.L.S. Critical revision of the manuscript for important intellectual content: all authors. Statistical analysis: J.L. Obtained funding: R.D.J. and M.L.S.
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