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ORIGINAL PAPER

Physical isolation and mental health among older US adults during the COVID-19 pandemic: longitudinal findings from the COVID-19 Coping Study

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Abstract

Purpose We investigated the relationships between physical isolation at home during the period when many US states had shelter-in-place orders and subsequent longitudinal trajectories of depression, anxiety, and loneliness in older adults over a 6 month follow-up.

Methods Data were from monthly online questionnaires with US adults aged ≥ 55 in the nation-wide COVID-19 Coping Study (April through October 2020, $N = 3978$). Physical isolation was defined as not leaving home except for essential purposes (0, 1–3, 4–6, and 7 days in the past week), measured at baseline (April–May). Outcomes were depressive symptoms (8-item Center for Epidemiological Studies Depression Scale), anxiety symptoms (5-item Beck Anxiety Inventory), and loneliness (3-item UCLA loneliness scale), measured monthly (April–October). Multivariable, population- and attrition-weighted linear mixed-effects models assessed the relationships between baseline physical isolation with mental health symptoms at baseline and over time.

Results Physical isolation (7 days versus 0 days in the past week) was associated with elevated depressive symptoms (adjusted $\beta = 0.85$; 95% CI 0.10–1.60), anxiety symptoms (adjusted $\beta = 1.22$; 95% CI 0.45–1.98), and loneliness (adjusted $\beta = 1.06$; 95% CI 0.51–1.61) at baseline, but not with meaningful rate of change in these mental health outcomes over time. The symptom burden of each mental health outcome increased with increasing past-week frequency of physical isolation.

Conclusion During the early COVID-19 pandemic, physical isolation was associated with elevated depressive symptoms, anxiety symptoms, and loneliness, which persisted over time. These findings highlight the unique and persistent mental health risks of physical isolation at home under pandemic control measures.

Keywords Aging · Mental health · Isolation · Loneliness

Introduction

Mental health disorders in middle-to-later life are highly prevalent and associated with poor health outcomes, including cognitive decline, dementia, and risk of mortality [1, 2]. Cross-sectional data from the early months of the COVID-19 pandemic in the United States have indicated elevated prevalence of depression and loneliness across all age groups [3–5], and that middle-aged adults were at particularly high risk of poor mental health outcomes [6–8]. Since middle-aged and older adults are more likely to have multiple comorbid health conditions, they are at elevated risk for severe morbidity and mortality due to COVID-19 [9, 10]. Consequentially, they may experience a greater degree of physical isolation to reduce their risk of COVID-19 infection than younger population groups. However, the longitudinal relationships between physical isolation and changes in mental health symptomatology over time among middle-aged and older adults over the course of the COVID-19 pandemic remain unknown.

Under public health orders and recommendations to limit the spread of COVID-19, older adults may be socially isolated, physically isolated, or both. Social isolation, defined as

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an inadequate quantity and quality of social relationships [11], has been associated with a range of adverse health outcomes in middle-aged and older adults, including depressive symptoms, cognitive decline, cardiovascular disease, and risk of all-cause mortality [11–16]. In contrast to social isolation, less is known about the health effects of physical isolation for pandemic control, defined here as not leaving home except for essential purposes, in line with pandemic control policies in the United States in Spring 2020 [17]. The pandemic control orders have created a need to investigate the potential long-term mental health impacts of physical isolation at home, independent of social isolation, which may be minimally or greatly altered during the pandemic depending on the nature of individuals' pre-pandemic social relationships [18].

Physical isolation may be linked to changes in mental health that are distinct from those previously observed with social isolation. Humans are intensely social creatures, and the task of physical isolation is inherently stressful for many people [19]. Prior to the COVID-19 pandemic, homebound status had been associated with incident depressive symptoms in older adults [20]. Daily variability in physical location outside the home has been associated with increased positive affect, likely due to hippocampal activity that drives dopamine release [21]. Mice chronically housed alone have been shown to have reduced activity in serotonergic neurons, which are crucial for mood regulation [22]. Remaining at home and having limited opportunities for varied forms of in-person interaction may thus directly prime the brain for vulnerability to mood dysregulation and mental health decline.

The COVID-19 pandemic has created an urgent need to understand the longitudinal mental health trajectories of middle-aged and older adults, especially with respect to the physical isolation uniquely imposed by the pandemic. We thus aimed to investigate the relationships between physical isolation at home during the period when most US states were under shelter-in-place orders (April and May 2020), and the subsequent longitudinal trajectories of depressive symptoms, anxiety symptoms, and loneliness over a six-month follow-up. We hypothesized that: (1) physical isolation would be associated with increased depressive symptoms, anxiety symptoms, and loneliness at baseline (April and May 2020); and (2) physical isolation would be associated with worsening depressive, anxiety, and loneliness symptoms over time (April through October 2020).

Methods

Study design and population

We used data from the COVID-19 Coping Study, a national longitudinal cohort study of US adults aged ≥ 55 years in all 50 US states, the District of Columbia, and Puerto Rico [23]. Details of the study design, recruitment methods, and data collection are available elsewhere [23, 24]. In brief, participants were recruited from April 2nd to May 31st, 2020, through a non-probability multi-frame sampling strategy, which included a "snowball sample" and "panel sample" [24]. Data were collected through online questionnaires administered via the University of Michigan Qualtrics software in English and Spanish. Consenting participants from the English-language snowball sampling frame were eligible for monthly follow-up questionnaires. The present analysis used data from the English-language snowball sample ($N = 4401$) at baseline (April/May 2020) and five subsequent monthly follow-up waves through September/October 2020. Participants were excluded if they were missing physical isolation data at baseline (136/4,401; 3.1%) or mental health outcome data at every wave (36/4,401; 0.8%). Participants were further excluded if they were missing covariate data at baseline (251/4,401; 5.7%) to give an analytical sample of 3978 (Fig. 1).

Exposure: physical isolation

Physical isolation at baseline was assessed by the following question: "In the past week, how many days have you been self-isolating (not left your residence except for essential purposes such as work, obtaining food, medications, or other supplies, outdoor exercise, or taking care of pets)?" Response options were 0 days, 1–3 days, 4–6 days, or 7 days.

Outcomes: depression, anxiety, and loneliness

Depressive symptoms were measured at baseline and each follow-up wave using the 8-item Center for Epidemiological Studies Depression (CES-D) Scale adapted from the US Health and Retirement Study [25]. Participants were asked if in the past week, much of the time they: (1) felt depressed; (2) felt everything they did was an effort; (3) felt their sleep was restless; (4) felt they were happy; (5) felt lonely; (6) enjoyed life; (7) felt sad; and (8) felt they could not get going. Response options were "yes" or "no". Each "yes" was scored as 1 point, with the exception of items 4 and 6, where answers of "no" were scored as 1 point. The total CES-D score was calculated as the sum of the above responses, with possible scores ranging from 0 to 8.

Anxiety symptoms were measured at baseline and each follow-up wave using the 5-item Beck Anxiety Inventory (BAI), adapted from the US Health and Retirement Study [26]. Participants were asked how much of the time in the past week they: (1) had fear of the worst happening; (2) were nervous; (3) felt their hands trembling; (4) had a fear of dying; and (5) felt faint. Response options were "never", "hardly ever", "some of the time," and "most of the time",

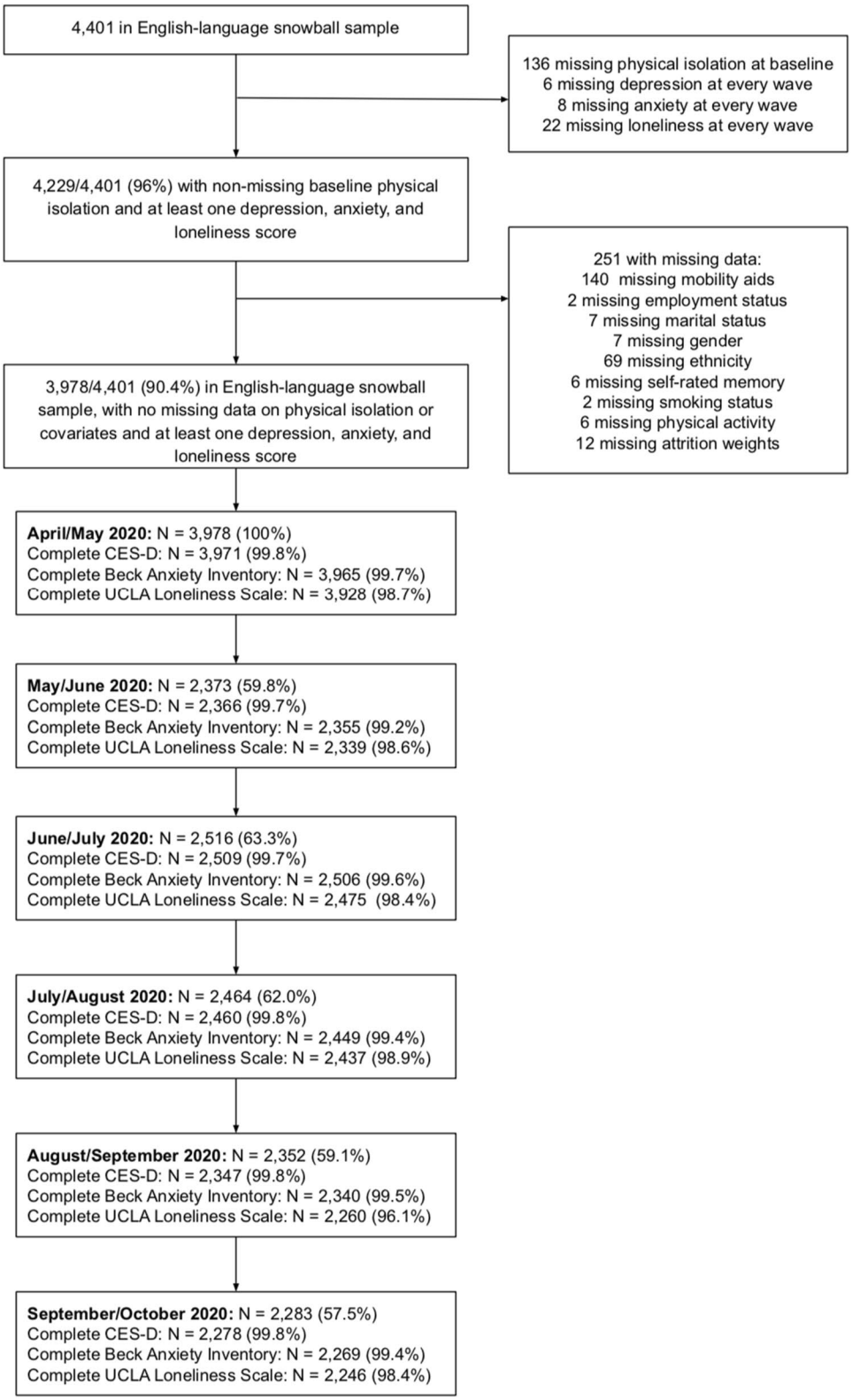

Fig. 1 Study flow diagram

corresponding to scores of 1–4 points, respectively. The total anxiety score was calculated as the sum of the above responses, with possible scores ranging from 4 to 20.

Loneliness was measured at baseline and each follow-up wave using the 3-item UCLA Loneliness Scale [27]. Participants were asked how often they felt: (1) they lacked

companionship; (2) left out; and (3) isolated from others in the past week. Response options were "hardly ever", "some of the time", and "often", corresponding to scores of 1–3 points, respectively. The total loneliness score was calculated as the sum of the above responses, with possible scores ranging from 3 to 9.

Covariates

Potential sociodemographic, health-related, and social confounders of the relationships between physical isolation and the three mental health outcomes were assessed at baseline. Sociodemographic covariates were age (years), sex (male, female), race (White, Black, Asian, other), ethnicity (Hispanic/Latinx, non-Hispanic/Latinx), education (high school or less, some college, college graduate, graduate school), and pre-COVID-19 employment status (retired or in school, self-employed, full-time, part-time, unable to work due to disability or health condition, homemaker or family caregiver, unemployed and seeking work). Health-related covariates were use of mobility aids (yes, no), number of physician-diagnosed health conditions (0, 1, 2, 3 +) of the following conditions: hypertension, diabetes, asthma, chronic obstructive pulmonary disease, cancer, or other limiting, long-standing health condition, self-rated memory (poor, fair, good, very good, excellent), smoking status (never smoker, ex-smoker, current smoker), and pre-COVID-19 moderate-to-vigorous intensity exercise per week (none to 2.5 + hours, in 30 min increments). Social covariates were relationship status (single-never married, single-divorced/separated, single-widowed, married or in a relationship) and pre-COVID-19 social isolation, measured as a 5-point social isolation index from the English Longitudinal Study of Ageing [28], which captured living alone, membership in social organizations or clubs, and frequency of contact with each of children, other family, and friends.

Statistical analyses

We generated sampling weights to match the general US population aged ≥ 55 based on demographic data from the 2018 American Community Survey, which were applied to all analyses [23]. Population-weighted proportions were estimated to describe the characteristics of the sample at baseline. We used multivariable linear mixed-effects models with random person-specific intercepts and slopes to assess the relationships between baseline physical isolation with levels of depression, anxiety, and loneliness at baseline (intercept), and changes in depression, anxiety, and loneliness over the six-month follow-up (slopes). Separate models for each of depression, anxiety, and loneliness were estimated. The models were estimated using maximum likelihood with an unstructured covariance matrix for the random effects to allow the correlation between the intercepts and the slopes to be estimated. All models adjusted for all covariates described in the previous section and were weighted to the general US population aged ≥ 55 and to account for potential non-random study attrition over the follow-up, using joint population and attrition (inverse probability of retention) weights. All analyses were conducted using Stata 17.0 SE (College Station, TX).

Sensitivity analyses

We ran a series of sensitivity analyses to further assess the relationships between physical isolation and mental health. First, to evaluate whether the potential impacts of physical isolation would be altered by levels of pre-existing social contacts both in and outside the home, we examined for effect modification by pre-COVID-19 social isolation by stratifying each model by score on the 5-point social isolation index (< 2 and ≥ 2, where a score ≥ 2 represented the top quartile in the analytical sample) as well as by living alone status (yes/no).

Next, we re-ran our models with imputed missing values of previous physician diagnosis of depression and anxiety. We chose to impute these values because previously diagnosed depression and anxiety may be important predictors of mental health during the pandemic, but were missing for > 5% of the sample [29]. Previous physician diagnoses of depression and anxiety were assessed at follow-up months 2 and 3 and were subsequently missing for individuals who did not complete either of these waves ($N = 949/3978$) or who had missing data on previous diagnosis of depression and anxiety ($N = 338/3978$) at these waves. We performed multiple imputation by chained equations (MICE) [29] to impute 20 datasets with imputed values for each of previous physician diagnoses of depression of anxiety, with the following covariates in the imputation models: age, sex, race, ethnicity, education, relationship status, pre-COVID-19 employment status, use of mobility aids, number of other physician-diagnosed conditions, self-rated memory, smoking status, pre-COVID-19 moderate to vigorous intensity physical activity per week, and pre-COVID-19 social isolation index score.

Results

Median follow-up time of the sample was 6 months (IQR = 3–6 months). Characteristics of the sample are shown in Table 1. Mean age at baseline was 67.5 years (95% CI 66.5, 68.4; range 55–99), and just over half the sample was female (53.4%; 95% CI 48.4, 58.3; Table 1). At baseline (April–May 2020), approximately two-thirds of participants physically isolated at home for seven days in the past week

(68.0%; 95% CI 63.0, 72.6), while 7.1% reported no days of physical isolation in the past week (95% CI 4.7, 10.5).

In population- and attrition-weighted, multivariable-adjusted linear mixed effects models, physical isolation for 7 days in the past week was associated with elevated depressive symptoms at baseline ($\beta_{\text{isolation 7 days}} = 0.85$; 95% CI 0.10, 1.60, vs. 0 days), and was associated with a slight increase in depressive symptoms over time ($\beta_{\text{time} \times \text{isolation 7 days}} = 0.09$; 95% CI 0.002, 0.18; Table 2; Fig. 2). There was a statistically significant dose–response relationship between the frequency of physical isolation and depressive symptoms at baseline, whereby increasing levels of physical isolation were associated with increasing magnitude of depressive symptoms ($p_{\text{trend}} = 0.04$; Table 2). All frequencies of physical isolation were associated with elevated anxiety symptoms at baseline in a dose–response fashion ($p_{\text{trend}} = 0.03$), relative to no physical isolation. Physical isolation was not associated with rate of change in anxiety symptoms over time (Time x Isolation coefficients in Table 2; Fig. 2). Similarly, all frequencies of physical isolation were associated with elevated loneliness at baseline in a dose–response fashion ($p_{\text{trend}} = 0.002$), relative to no physical isolation, but were not associated with rate of change in loneliness over time (Table 2; Fig. 2).

Pre-COVID-19 social isolation appeared to modify the relationship between physical isolation and depressive symptoms, but not its relationships with anxiety symptoms or loneliness. Experiencing 7 versus 0 days of physical isolation in the past week was associated with elevated depressive symptoms at baseline for those with high but not low pre-COVID-19 social isolation (high social isolation: $\beta = 1.90$; 95% CI 0.90, 2.90; low social isolation: $\beta = 0.23$; 95% CI − 0.72, 1.19; Supplementary Table 1). Living alone modified the relationships of physical isolation with anxiety symptoms and loneliness, but not depressive symptoms. Physical isolation was associated with elevated anxiety and loneliness symptoms at baseline only among those who did not live alone (Supplementary Table 2). Results from models with imputed values for previous diagnoses of depression and anxiety as covariates were consistent with the main results, indicating that these previous diagnoses are not meaningful confounders of the relationships between physical isolation and mental health symptoms over the study period (Supplementary Table 3).

Discussion

In this longitudinal study of US adults aged ≥ 55 throughout the first six months of the COVID-19 pandemic, physical isolation at home was associated with elevated depressive symptoms, anxiety symptoms, and loneliness during the early period of the pandemic when most US states were under shelter-in-place orders. These elevated symptoms persisted over time. Individuals who isolated 7 days per week experienced a slight increase in depressive symptoms over time, but anxiety and loneliness did not meaningfully change over the 6 month follow-up. The association between physical isolation and depressive symptoms was the strongest among those who were socially isolated prior to the COVID-19 pandemic. The association between physical isolation and anxiety symptoms was strongest among those who lived in multi-person households, potentially reflective of COVID-19 transmission risk within households. The association between physical isolation and loneliness was also strongest among those who lived in multi-person households, possibly reflecting a higher preference for solitude among those living alone. These associations were independent of a range of demographic, social, and health-related variables, including previous diagnoses of depression and anxiety. Overall, this study highlights the unique and persistent mental health risks of physical isolation at home under pandemic control measures among older adults.

Our results are consistent with descriptive longitudinal analyses conducted across similar time periods in the US and globally. Most studies identified a peak in symptoms of anxiety, depression, and loneliness early in the pandemic (March–May 2020) [30–33], followed by either no change [34] or a decrease [30–33] in symptoms over time. Results from this study add critical details to the growing body of literature on mental health during the COVID-19 pandemic. Our findings suggest that physical isolation, a nearly ubiquitous experience during the pandemic, poses a unique threat to mental health over and above social isolation. Previous qualitative research has highlighted "*the lack of relationship practices in their embodied form*" as a major source of negative affect [35]. Neuroscience experiments have demonstrated both the benefits of variability in physical location [21], as well as the neurobiological consequences of physical isolation [22, 36]. As one of the first studies to examine longitudinal mental health implications of physical isolation at home at the population level, our results complement these qualitative and neurobiology findings from an epidemiological perspective.

While physical isolation was associated with symptoms of depression, anxiety, and loneliness at baseline in this study, there were no significant changes in these mental health symptoms over time, apart from a slight increase in depressive symptoms for those who isolated 7 days per week. These results may indicate that older adults began mentally adapting to the ongoing pandemic restrictions in a way that allowed their mental health to remain relatively stable over time [30]. Indeed, this finding supports qualitative research and cross-sectional surveys identifying mental resiliencies of older adults during the early months of the pandemic [24, 37–39].

Table 1 Population-weighted characteristics of the sample, COVID-19 Coping Study, United States, April–October 2020 ($N = 3978$)

Characteristic	Proportion	95% CI
Sex		
Male	46.6	(41.6, 51.6)
Female	53.4	(48.4, 58.3)
Age		
Mean	67.5	(66.5, 68.4)
Race		
White	82.0	(77.5, 85.6)
Black	9.7	(7.0, 13.4)
Asian	4.3	(2.4, 7.3)
Other	4.1	(2.5, 6.5)
Ethnicity[a]		
Non-hispanic or latinx	94.8	(92.1, 96.6)
Hispanic or latinx	5.2	(3.4, 7.9)
Highest level of education		
High school or less	37.7	(32.3, 43.4)
Some college	30.0	(26.0, 34.3)
College graduate	17.9	(15.6, 20.5)
Graduate or professional school	14.4	(12.5, 16.5)
Relationship status		
Single, never married	9.3	(6.5, 13.2)
Single, divorced/separated	17.7	(14.1, 21.9)
Single, widowed	15.0	(11.5, 19.2)
Married or in a relationship	58.1	(53.0, 63.0)
Pre-COVID-19 social isolation		
Less than monthly contact with children, or no children	23.6	(19.6, 28.2)
Less than monthly contact with family, or no family	16.0	(12.8, 19.8)
Less than monthly contact with friends, or no friends	10.4	(7.4, 14.3)
Less than monthly participation in a club, or no club	39.8	(35.0, 44.9)
Lives alone	27.6	(23.3, 32.5)
Use of a mobility aid		
No	90.3	(87.0, 92.8)
Yes	9.7	(7.1, 13.0)
Number of physician-diagnosed chronic conditions[b]		
0	26.6	(22.6, 31.1)
1	34.7	(30.0, 39.6)
2	19.6	(16.0, 23.7)
3 +	19.1	(15.4, 23.3)
Pre-COVID-19 weekly frequency of physical activity		
None	9.6	(6.7, 13.5)
< 30 min	15.6	(12.0, 20.1)
30–60 min	12.2	(9.3, 15.9)
1–1.5 h	9.3	(6.9, 12.5)
1.5–2 h	8.7	(6.4, 11.9)
2–2.5 h	11.0	(8.2, 14.6)
2.5 + hours	33.6	(29.3, 38.1)
Smoking status		
Never smoker	46.4	(41.6, 51.4)
Ex-smoker	43.9	(39.0, 48.9)
Current smoker	9.7	(6.8, 13.5)
Self-rated memory		
Poor	1.9	(0.9, 4.0)

Table 1 (continued)

Characteristic	Proportion	95% CI
Fair	12.6	(9.2, 16.9)
Good	32.3	(27.7, 37.2)
Very Good	34.7	(30.4, 39.4)
Excellent	18.5	(15.3, 22.3)
Pre-COVID-19 employment status		
Retired or in school[c]	48.1	(43.2, 53.0)
Self employed	8.2	(5.7, 11.7)
Employed full time	18.1	(14.8, 21.8)
Employed part time	8.8	(6.5, 11.9)
Unable to work (disability to health condition)	11.0	(7.8, 15.3)
Homemaker or family caregiver	3.7	(2.1, 6.5)
Unemployed and seeking work	2.1	(1.0, 4.4)
Physical isolation at baseline (days/week)[d]		
0 days	7.1	(4.7, 10.5)
1–3 days	9.5	(6.9, 12.9)
4–6 days	15.4	(11.9, 19.6)
7 days	68.0	(63.0, 72.6)

[a]Indicates Hispanic/Latinx of any race

[b]Chronic conditions were physician-diagnosed hypertension, heart disease, diabetes, asthma, chronic obstructive pulmonary disease, cancer, and any other limiting, long-standing condition

[c]$N = 2/3978$ for "in-school" employment status

[d]Defined as not leaving home except for essential purposes (work, obtaining food, medications, or other supplies, outdoor exercise, or taking care of pets) in the past week

Table 2 Results from linear mixed effects models for the associations between physical isolation and mental health at baseline and over time, COVID-19 Coping Study, United States, April–October 2020 ($N = 3978$)

Predictor	Depression[a]		Anxiety[b]		Loneliness[c]	
	β	95% CI	β	95% CI	β	95% CI
Intercept	5.10	(2.08, 8.11)	8.86	(5.56, 12.15)	5.54	(3.56, 7.53)
Physical isolation in past week						
1–3 days	0.48	(−0.39, 1.35)	1.14	(0.24, 2.03)	0.89	(0.18, 1.60)
4–6 days	0.81	(−0.04, 1.66)	1.24	(0.19, 2.28)	0.79	(0.11, 1.48)
7 days	0.85	(0.10, 1.60)	1.22	(0.45, 1.98)	1.06	(0.51, 1.61)
p-trend	0.04		0.03		0.002	
Time	−0.04	(−0.10, 0.02)	−0.06	(−0.15, 0.03)	0.04	(−0.03, 0.11)
Time × isolation						
1–3 days	0.23	(−0.03, 0.49)	0.09	(-0.13, 0.31)	−0.03	(−0.16, 0.11)
4–6 days	−0.15	(−0.37, 0.06)	−0.01	(-0.16, 0.14)	−0.08	(−0.24, 0.07)
7 days	0.09	(<0.01, 0.18)	0.06	(-0.06 0.17)	0.02	(−0.06, 0.11)

All models were adjusted and weighted to the US general population and to account for attrition after baseline. The intercept represents the mean baseline value of the outcome for an individual in the reference category of model covariates: age 55, male, White, Non-Hispanic or Latinx ethnicity, less than high school education, single (never married) relationship status, pre-COVID-19 social isolation score of 0, no use of mobility aids, no comorbid conditions, no moderate to vigorous physical activity, never smoking, poor self-rated memory, and retired pre-COVID-19 employment status

[a]8-item Center for Epidemiologic Studies Depression Scale (CES-D)

[b]5-item Beck Anxiety Inventory (BAI)

[c]3-item UCLA Loneliness Scale

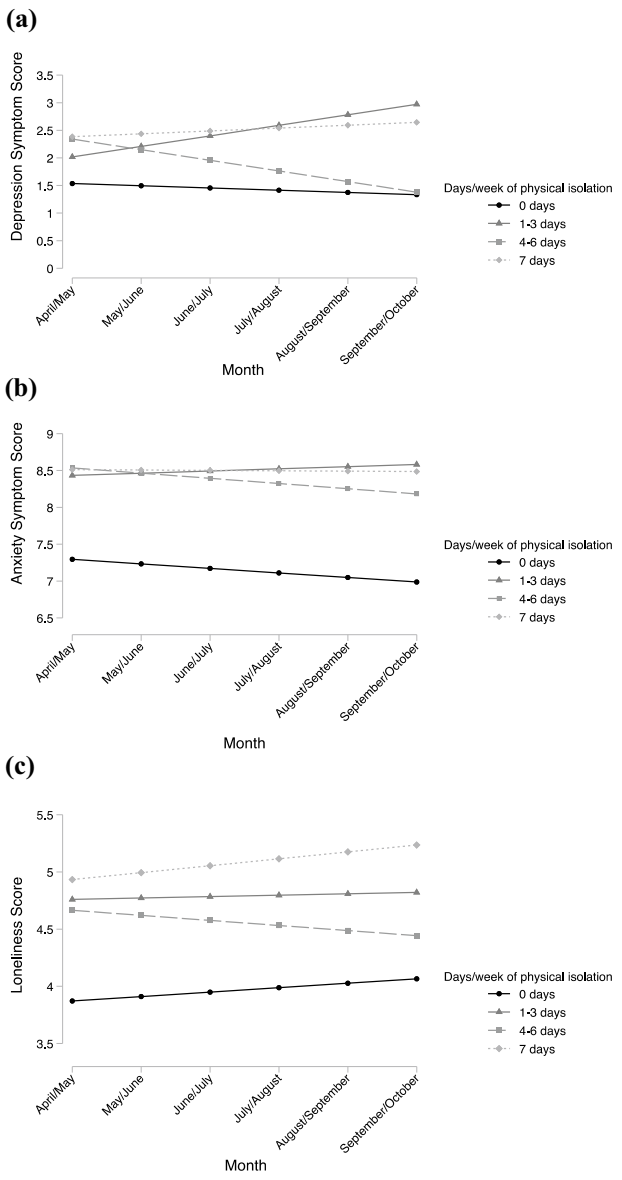

Fig. 2 Mental health symptom trajectories for (**a**) depression, **b** anxiety, and **c** loneliness according to baseline level of physical isolation, April–October 2020, from population- and attrition- weighted linear mixed effects models, $N = 3978$

It remains unclear whether the levels of symptoms of depression, anxiety, and loneliness observed among older adults in this study and others are outside the bounds of an appropriate emotional response to living through the pandemic [40]. While some have described COVID-19 as a "mental health pandemic" [41–43], it is important to recognize that the symptoms measured by depression, anxiety, and loneliness scales can represent short-term emotional reactions, and not necessarily pathological syndromes that affect an individual's ability to function over time [44]. However, one of the challenges with tracking mental health during the pandemic has been delayed diagnosis and underdiagnoses in clinical settings [45]. The mental health symptom scales we used in this study likely capture both clinically diagnosable depression and anxiety, as well as subclinical and undiagnosed conditions, overcoming the some of the limitations of relying on medical record data.

This study has limitations. The study sample was recruited through institutional health research databases, such as NIH ResearchMatch, as well as word-of-mouth snowball sampling. Snowball sampling has previously shown effective in recruiting under-represented individuals who may not have heard of the study otherwise, although it may over-represent individuals who have social networks [46]. Thus, we may have underestimated the magnitude of the associations between physical isolation and the mental health outcomes, as we may not have captured the most isolated older adults in this study. We dealt with this potential bias as best possible by applying population-based weights generated using American Community Survey data to our analysis. Results may not be generalizable to those who do not use the Internet or mobile data if the associations under study do not hold in these subpopulations, which may include those without financial means to access the Internet or a smartphone, or who are experiencing homelessness or are institutionalized [47, 48]. Since data collection began during the first wave of the COVID-19 pandemic, we did not have pre-COVID-19 data on the outcomes measured in this sample. While sensitivity analyses indicated that previous physician diagnoses of depression and anxiety were not empirical confounders of the relationships under study, we cannot rule out the possibility that the individuals who physically isolated the most intensely were also experiencing greater undiagnosed mental health symptomatology at the pandemic onset. Finally, levels of physical isolation likely changed over time for some study participants. Future work is needed to assess for potential bidirectional relationships between physical isolation and mental health over time.

This study has several key strengths. Its longitudinal design included a baseline measurement during a unique period when most of the US was under shelter-in-place orders [49], and five subsequent follow-up surveys at monthly intervals. This study is among the first to report longitudinal mental health data in the US during the COVID-19 pandemic in relation to physical isolation during the early pandemic period. Our recruitment strategy allowed us to rapidly enroll a national cohort at low cost during the first wave of the COVID-19 pandemic. This study had a large sample size covering all 50 US states and the District of Columbia, it incorporated population sampling and attrition weights to minimize potential bias and improve generalizability, and we had rich covariate data. We utilized commonly used validated research scales capturing depressive symptoms, anxiety symptoms, and loneliness, facilitating comparability of our results to those

of other studies, such as the US Health and Retirement Study and its International Partner Studies of aging.

Conclusion

In this longitudinal study of nearly 4000 older adults in the US during the COVID-19 pandemic, we observed that physical isolation at home during the early pandemic period was associated with elevated depressive symptoms, anxiety symptoms, and loneliness at baseline, and these elevated symptoms were persistent over time. A remaining question is whether the levels of symptoms of depression, anxiety, and loneliness observed among older adults in this study extend beyond an appropriate emotional response to the stress of the pandemic. Physical isolation, a near ubiquitous experience among older adults during the COVID-19 pandemic, may pose a unique threat to mental health independent of a wide range of demographic, health, and social factors. This finding supports prior research establishing a link between physical isolation and challenges to mental health. Given the global scale of physical isolation during COVID-19, it is critical that additional research in other populations and geographic locations continues to investigate the longitudinal mental health impacts of physical isolation.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00127-022-02248-4.

Author contributions CAJ and LCK designed the study. CAJ performed data analysis and drafted the manuscript. LCK supervised the analyses and the writing of the manuscript. All authors critically revised the final manuscript.

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Availability of data and material Data from this study are publicly available from the Inter-University Consortium for Political and Social Research (ICPSR) at the University of Michigan, at: https://www.openicpsr.org/openicpsr/project/131022/version/V1/view.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethics approval The University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board approved the COVID-19 Coping Study protocol (HUM00179632).

Consent to participate Online informed consent was obtained from all participants.

Consent for publication All authors approve of the article for publication.

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