




CLINICAL INVESTIGATION

Persistent loneliness due to COVID-19 over 18 months of the pandemic: a prospective cohort study

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Abstract

Background: Loneliness was common early in the COVID-19 pandemic due to physical distancing measures, but little is known about how loneliness persisted into later stages of the pandemic. We therefore examined longitudinal trajectories of loneliness over 18 months of the pandemic and subgroups at risk for persistent loneliness.

Methods: We used data from the COVID-19 & Chronic Conditions study collected between March 27, 2020 to December 10, 2021, including 641 predominantly older adults with ≥ 1 chronic condition who completed six interviews at approximately 3 month intervals. Participants reported loneliness (defined as some, most, or all of the time) during the past week due to COVID-19. We used trajectory mixture models to identify clusters of individuals following similar trajectories of loneliness, then determined subgroups likely to be classified in different loneliness trajectories using multivariable regression models adjusted for sociodemographic and clinical covariates.

Results: Participants were on average 63 years old, 61% female, 30% Black, 20% Latinx, and 29% were living below the poverty level. There was an overall reduction in loneliness over time (March to April/2020: 51% to September to December/2021: 31%, $p = 0.01$). Four distinct trajectory groups emerged: (1) “Persistent Loneliness” ($n = 101$, 16%); (2) “Adapted” ($n = 141$, 22%), individuals who were initially lonely, with feelings of loneliness decreasing over time; (3) “Occasional loneliness” ($n = 189$, 29%); and (4) “Never lonely” ($n = 211$, 33%). Subgroups at highest risk of the “Persistently Lonely” trajectory included those identifying as Latinx (aOR 2.5, 95% CI: 1.2, 5.2), or living in poverty (aOR 2.5; 95% CI: 1.4, 4.6).

Conclusions: Although loneliness declined for a majority of older adults during the pandemic in our sample, persistent loneliness attributed to the

COVID-19 pandemic was common (1 in 6 adults), particularly among individuals identifying as Hispanic/Latinx or living in poverty. Interventions addressing loneliness can ease pandemic-related suffering, and may mitigate long-term mental and physical health consequences.

KEYWORDS

chronic illness, COVID-19 pandemic, loneliness

INTRODUCTION

Social restrictions early in the COVID-19 pandemic led to forced social isolation and feelings of loneliness among many struggling to cope with restrictions. This isolation was intensified among older adults and middle-age adults with serious or chronic conditions. Both groups were at increased risk of severe complications from COVID-19 and may have avoided in-person social activities.¹ Many older adults reported emotional resilience to social restrictions early in the pandemic, yet, an important subset experienced greater loneliness and overall stress.² These individuals more frequently described difficulty emotionally coping, had prior diagnoses of anxiety or depression, or difficulty using technology-based communication. Despite substantial documentation on experiences of loneliness at the onset of the pandemic, it is unclear if and how loneliness has persisted or re-emerged throughout the duration of the pandemic among older adults and adults with chronic illnesses who have remained at greater risk of severe COVID-19 as newer variants have emerged.

Persistent or chronic feelings of loneliness, in comparison to transient loneliness, is strongly linked to long-term physical and mental health outcomes.^{3,4} Transient loneliness is common throughout the lifespan, and while distressing in the short-term it can often motivate individuals to reconnect with social relationships or the community.^{5,6} However, individuals already experiencing socially or medically disrupting circumstances, such as chronic illness, widowhood, late life disability, or mental health concerns, combined with the restrictions of the pandemic, may experience greater barriers to coping with loneliness. Prolonged states of loneliness can lead to sustained psychological distress and depression,⁷ long-term changes in health behaviors,⁸ and reduced access to health care, all of which can lead to declines in physical function or difficulty adapting to functional impairment.^{9,10} Yet, after nearly 2 years of COVID-19 restrictions, there remain several critical knowledge gaps. First, a lack of available longitudinal data has made it unclear if prolonged feelings of loneliness during the pandemic has been common. Second, little is known

Key points

- In a prospective cohort of 641 diverse adults with chronic conditions followed from March of 2020 to December of 2021 of the COVID-19 pandemic, we identified four trajectories of loneliness: (1) persistent loneliness, (2) individuals who adapted over time, (3) occasional loneliness, and (4) never lonely.
- Overall, approximately 1 in 6 participants (16%) experienced persistent loneliness attributed to the COVID-19 pandemic, and rates were highest among individuals living below the poverty line (24%) or identifying as Hispanic/Latinx (28%).
- Protective factors for individuals who reported never feeling lonely or who adapted over time included being married, living with others, being of higher socioeconomic status, and having low levels of pre-COVID-19 anxiety and depressive symptoms.

Why does this paper matter?

Study findings can inform efforts to address the immediate and long-term health and social consequences of loneliness among adults with chronic conditions who may be both at higher risk of COVID-19 related complications and have social lives significantly disrupted by pandemic events.

about the diversity of experiences and trajectories of loneliness as the pandemic has progressed. A better understanding of risk factors and protective factors could improve risk stratification and tailoring of comprehensive interventions. Third, limited data exists on experiences of loneliness among racially and ethnically diverse, low-income communities with chronic or serious illness during the pandemic. Prior literature suggests that individuals with lower income, a higher burden of chronic

illness, mental health challenges, or living alone may be as higher risk of persistent loneliness.¹¹ While there has been an intense focus on medical care for adults at higher risk of COVID-19 related medical complications, addressing social factors like loneliness may be equally important to helping individuals recover from the health effects of pandemic restrictions.

Identifying adults at risk for persistent loneliness can inform social interventions and public health strategies that recognize the health tradeoffs between social restrictions and reducing COVID-19 transmission. This study therefore examined trajectories of loneliness between March 2020 and December 2021 using a unique longitudinal cohort of diverse adults with chronic conditions, and identified subgroups at risk for persistent loneliness.

METHODS

We used data from the COVID-19 & Chronic Conditions (C3) study.¹² The C3 study began at the onset of the US declaration of a public health emergency (March 13–20, 2020), and is a longitudinal survey examining how adults with one or more chronic conditions are responding to the pandemic, taking action to minimize infection, and continuing to self-manage their chronic conditions. The study and purposefully enrolled individuals managing one or more chronic conditions who were at elevated risk for complications from COVID-19, and racially and ethnically diverse individuals from varying socioeconomic backgrounds.

The C3 cohort enrolled participants involved in one of five ongoing, National Institutes of Health (NIH)-funded health services research projects taking place among five academic internal medicine and two federally qualified health center primary care settings across the greater Chicago area. The academic internal medicine practices primarily serve patients residing in central and north Chicago, and the western Chicago suburbs. The federally qualified health centers mainly serve patients on the south, west and northwest Chicago regions, which experienced greater rates of COVID-19 infections throughout the pandemic. Inclusion criteria across studies varied by age, as one included adults of any age whereas the other four targeted middle age and older adults exclusively. Three studies focused on the presence of one or more chronic conditions (i.e., type 2 diabetes, chronic obstructive pulmonary disease, kidney transplant), one required patients to be taking five or more prescription medications for chronic conditions, and another was a longstanding cohort study of older adults. Common exclusion criteria for all studies include the presence of a severe, uncorrectable cognitive, visual or

hearing impairment that would preclude a participant's ability to complete interviews. Available pre-pandemic measures described below were consistent across studies unless otherwise noted.

From March 13–20, 2020, we enrolled 673 English- and Spanish-speaking individuals (response rate: 86%).¹² Participants were invited by trained research coordinators to complete seven telephone interviews (Wave 2: March 27–April 7, 2020, Wave 3: May 1–22, Wave 4: July 15–August 21, Wave 5: December 1–March 1, 2021, Wave 6: April 12–July 16, Wave 7: September 8–December 10 [Wave 7 retention 74%]). After obtaining verbal consent, the research coordinators administered the survey and recorded participants' responses using REDCap survey software. The study was approved by the Northwestern University Institutional Review Board.

Social measures

A single-question was used to assess loneliness “Over the past week, how often have you felt alone or lonely because of the coronavirus” (Responses: “Never,” “Some of the time,” “Most of the time,” or “All of the time”) with “Some of the time” or greater categorized as lonely.¹³ Prior literature indicates that a single question is comparable to longer loneliness scales during the pandemic.¹⁴ To measure objective social isolation, we used a modified Duke Social Support Index social interaction sub-scale as described in prior literature.^{15,16} The six-item scale includes the number of local contacts the participant feels close to or can depend on, the frequency of participation in community activities in the past week, and the frequency of social interaction (excluding interactions with co-residents) via telephone, video, internet, or in-person communication, for a total range of 0–17 points. Individuals were categorized as socially isolated if scoring ≤ 6 points on the 17-point scale, which represents minimal support or interaction from all sources.^{17,18}

Psychological measures

Psychological health was assessed among participants prior to the COVID-19 pandemic using the Patient Reported Outcomes Measurement Information Service (PROMIS) short-form instruments of depression and anxiety, which are validated and normed among the general US population.¹⁹ A raw score was calculated for each scale, then transformed into a corresponding *T*-score with a mean of 50 and standard deviation of 10; higher scores indicate more symptoms. The minimally important differences (a difference large enough to have

implications for an individual's treatment or care) range from 3 to 4.5 points for both the anxiety and depressive scales.^{20,21}

Demographic and health characteristics

Patient demographics and socioeconomic status were uniformly collected from all studies during parent study interviews, prior to the COVID-19 pandemic. Participants self-reported age, sex, race/ethnicity, education, household size, income levels, chronic conditions and marital status. Poverty was defined by the 2020 US federal poverty guidelines (annual income <\$12,760 for single-person households or <\$17,240 for 2+ person households).²² Chronic conditions included heart disease, lung diseases (COPD or asthma), coronary artery disease, hypertension, cancer, hypercholesterolemia, stroke, and diabetes. COVID-19 vaccination status was obtained starting in the sixth wave of data collection (April 2021 onward).

Analysis

Trajectory mixture models (SAS Proc Traj) were used to identify the optimal number of clusters of individuals following similar trajectories of loneliness through the pandemic. A total of 641 participants (95%) completed at least two interviews and were included in the trajectory analyses. Models were based on a Bernoulli distribution for the dichotomous loneliness outcome. Trajectories were allowed to vary by intercept, and to have linear or quadratic slopes by time. We sequentially tested models with up to four trajectory groups. Bayesian Information Criterion (BIC) and Jeffrey's scale were used to compare models and determine the optimal number of discrete trajectories.²³ After determining the final model, BIC was further used to determine the functional form of slope for each trajectory over time (linear vs. quadratic). The posterior group probabilities were calculated for each subject based on the estimated parameters, and the subject was assigned to a group based on the subject's highest posterior group probability. The average posterior probability for belonging to each group exceeded 0.7 indicating high discrimination between each group and good model fit.²⁴ We then examined sociodemographic and clinical differences in trajectory groups using bivariate statistics, including χ^2 tests, *t*-tests and analysis of variance. Post hoc tests were conducted to examine bivariate differences between those classified as "Persistent Loneliness" and "Adapted." A multivariate logistic regression model was then used to determine the adjusted association between

sociodemographic and clinical characteristics and clustering in the "Persistent Loneliness" group (considered the highest risk group), and adjusted odds ratios and 95% confidence intervals were estimated. The model included all covariates described above, as well as the site of the study. Statistical analyses were performed using SAS, version 9.4.

RESULTS

Participants were on average 63 years old (range: 23–91 years, 20–39 years old: 4%, 40–59 years: 31%, 60–74 years: 52%, 75–84: 13%, 85+ years: 1%), 61% female, 30% Black, 20% Hispanic/Latinx, and 29% were living below the poverty level (Table 1). There was a gradual reduction in the overall frequency of loneliness over time from 51% to 31% over the 18-month period with a rise during December 2020–March 2021 (49%) coinciding with the second US COVID-19 wave.

Using trajectory mixture models to determine the optimal number of distinct trajectories, we identified four trajectories (Figure 1): (1) "Persistent Loneliness" ($n = 101$, 16%), participants who reported loneliness in nearly all interviews (March 2020: 87% to December 2021: 100%); (2) "Adapted" ($n = 141$, 22%), who reported loneliness in 4 of 6 (61%) interviews on average with the frequency decreasing over time from 94% at baseline to 33% at the last follow-up, (3) "Occasional loneliness" ($n = 189$, 29%) who reported loneliness in 2 of 6 (29%) interviews on average over time, and (4) "Never lonely" ($n = 211$, 33%) who reported loneliness rarely in interviews (March 2020: 15% to December 2021: 0%) over time. Notably, the "Adapted" and "Occasional loneliness" groups experienced spikes in loneliness during the second COVID wave.

Sociodemographic and clinical comparisons of the four trajectory groups using bivariate statistics are shown in Table 1. Participants in the "Persistent Loneliness" group were more likely to be Hispanic/Latinx participants ($p = 0.004$), report low English proficiency ($p = 0.007$), and live below the poverty line ($p < 0.001$) than those in other trajectory groups. The "Never Lonely" group tended to be male, higher income, more educated, married, live with others, and have lower levels of pre-COVID depressive and anxiety symptoms compared with other trajectory groups.

We next examined differences between the "Persistent Loneliness" and "Adapted" groups as this might speak to mechanisms by which high risk groups adapted to pandemic restrictions (Table 1). Pre-existing mental health challenges emerged as a strong contributor; those experiencing persistent loneliness reported greater mean

anxiety (Persistent: 59.6 vs. Adapted: 53.5, $p < 0.001$) and depressive (Persistent: 55.1 vs. Adapted: 51.4, $p = 0.02$) symptoms before the start of the pandemic compared to those who adapted to restrictions (Table 1). In addition,

there were differences in rates of social isolation (Persistent: 40% vs. Adapted: 26%, $p = 0.03$). In contrast, the “Persistent Loneliness” and “Adapted” groups had similar proportions of being married (36% and 30%,

TABLE 1 Sample characteristics overall and by loneliness trajectory category (unadjusted)

	Overall <i>n</i> = 642	Never lonely <i>n</i> = 211	Occasional loneliness <i>n</i> = 189	Adapted to loneliness <i>n</i> = 141	Persistent loneliness <i>n</i> = 101	ANOVA <i>p</i> value	Adapted versus persistent <i>p</i> value*
Age, mean (SD)	62.8 (11.0)	62.7 (12.4)	62.5 (11.0)	63.4 (9.3)	62.9 (10.1)	0.89	0.69
Gender							
Female	392 (61.2)	116 (55.0)	116 (61.4)	95 (67.4)	65 (64.4)	0.11	0.62
Male	250 (38.9)	95 (45.0)	73 (38.6)	46 (32.6)	36 (35.6)		
Race/ethnicity ^a						0.004	0.01
Black	191 (30.2)	64 (30.8)	68 (36.4)	37 (26.6)	22 (22.2)		
Hispanic/Latinx	128 (20.2)	38 (18.3)	29 (15.5)	25 (18.0)	36 (36.4)		
Other ^a	18 (2.8)	4 (1.9)	8 (4.3)	3 (2.2)	3 (3.0)		
White	296 (46.8)	102 (49.0)	82 (43.9)	74 (53.2)	38 (38.4)		
Low English proficiency						0.007	0.15
Yes	68 (10.6)	21 (10.0)	11 (5.8)	17 (12.1)	19 (18.8)		
No	574 (89.4)	190 (90.0)	178 (94.2)	124 (87.9)	82 (81.2)		
Poverty level ^b						<0.001	0.01
Below poverty line	184 (28.9)	43 (20.7)	56 (29.6)	40 (28.8)	45 (44.6)		
Above poverty line	453 (71.1)	165 (79.3)	133 (70.4)	99 (71.2)	56 (55.4)		
Education						0.13	0.71
<High school	64 (10.0)	17 (8.1)	22 (11.6)	12 (8.5)	13 (12.9)		
High school grad	94 (14.6)	37 (17.5)	25 (13.2)	20 (14.2)	12 (11.9)		
Some college/ technical school	168 (26.2)	40 (19.0)	59 (31.2)	40 (28.4)	29 (28.7)		
College graduate	316 (49.2)	117 (55.4)	83 (43.9)	69 (48.9)	47 (46.5)		
Comorbidities						0.52	0.48
≥3 conditions	399 (62.2)	133 (63.0)	123 (65.1)	86 (61.0)	57 (56.4)		
<3 conditions	243 (37.8)	78 (37.0)	66 (34.9)	55 (39.0)	44 (43.6)		
Vaccination status ^c						0.98	0.96
Vaccinated	493 (91.8)	156 (91.2)	146 (92.4)	100 (91.7)	91 (91.9)		
Unvaccinated	44 (8.2)	15 (8.8)	12 (7.6)	9 (8.3)	8 (8.1)		
Social isolation ^d						0.21	0.03
Socially isolated	174 (32.7)	56 (32.8)	51 (32.9)	28 (25.9)	39 (39.8)		
Not socially isolated	358 (67.3)	115 (67.2)	104 (67.1)	80 (74.1)	59 (60.2)		
Marital status ^e						<0.001	0.33
Single	325 (59.0)	82 (46.1)	101 (63.1)	78 (69.6)	64 (63.4)		
Married/partnered	226 (41.0)	96 (53.9)	59 (36.9)	34 (30.4)	37 (36.4)		
Household size ^f						<0.001	0.97
Live alone	206 (33.3)	45 (22.6)	56 (30.4)	60 (44.8)	45 (44.6)		
Live with others	412 (66.7)	154 (77.4)	128 (69.6)	74 (55.2)	56 (44.5)		

(Continues)

TABLE 1 (Continued)

	Overall <i>n</i> = 642	Never lonely <i>n</i> = 211	Occasional loneliness <i>n</i> = 189	Adapted to loneliness <i>n</i> = 141	Persistent loneliness <i>n</i> = 101	ANOVA <i>p</i> value	Adapted versus persistent <i>p</i> value*
Depressive symptoms pre-COVID ^g , mean SD	48.8 (8.6)	44.0 (6.0)	48.7 (7.9)	51.4 (8.9)	55.1 (8.7)	<0.001	0.002
Anxiety symptoms pre- COVID ^h , mean (SD)	51.7 (8.9)	46.7 (7.0)	53.8 (8.8)	53.5 (7.5)	59.6 (8.1)	<0.001	<0.001

Note: All *p* values represent results from chi-square tests or ANOVA.

*Post-hoc analyses for differences between the “Persistently Lonely” and “Adapted” groups.

^aIn the “other” group 12 participants self-identified as Asian, 6 participants self-identified as multi-racial, 9 missing race data.

^bPoverty level was defined based on the US federal 2020 poverty level, five missing poverty data.

^cVaccinated individuals were defined as having received at least one dose of a COVID-19 vaccine. One hundred and five missing vaccination data.

^dSocial isolation was defined using the Duke Social Support Index. One hundred and ten missing social isolation data.

^eNinety one missing marital status data.

^fTwenty four missing household size data.

^gThirty eight missing pre-COVID depressive symptoms.

^hThree hundred and thirty six missing pre-COVID anxiety symptoms.

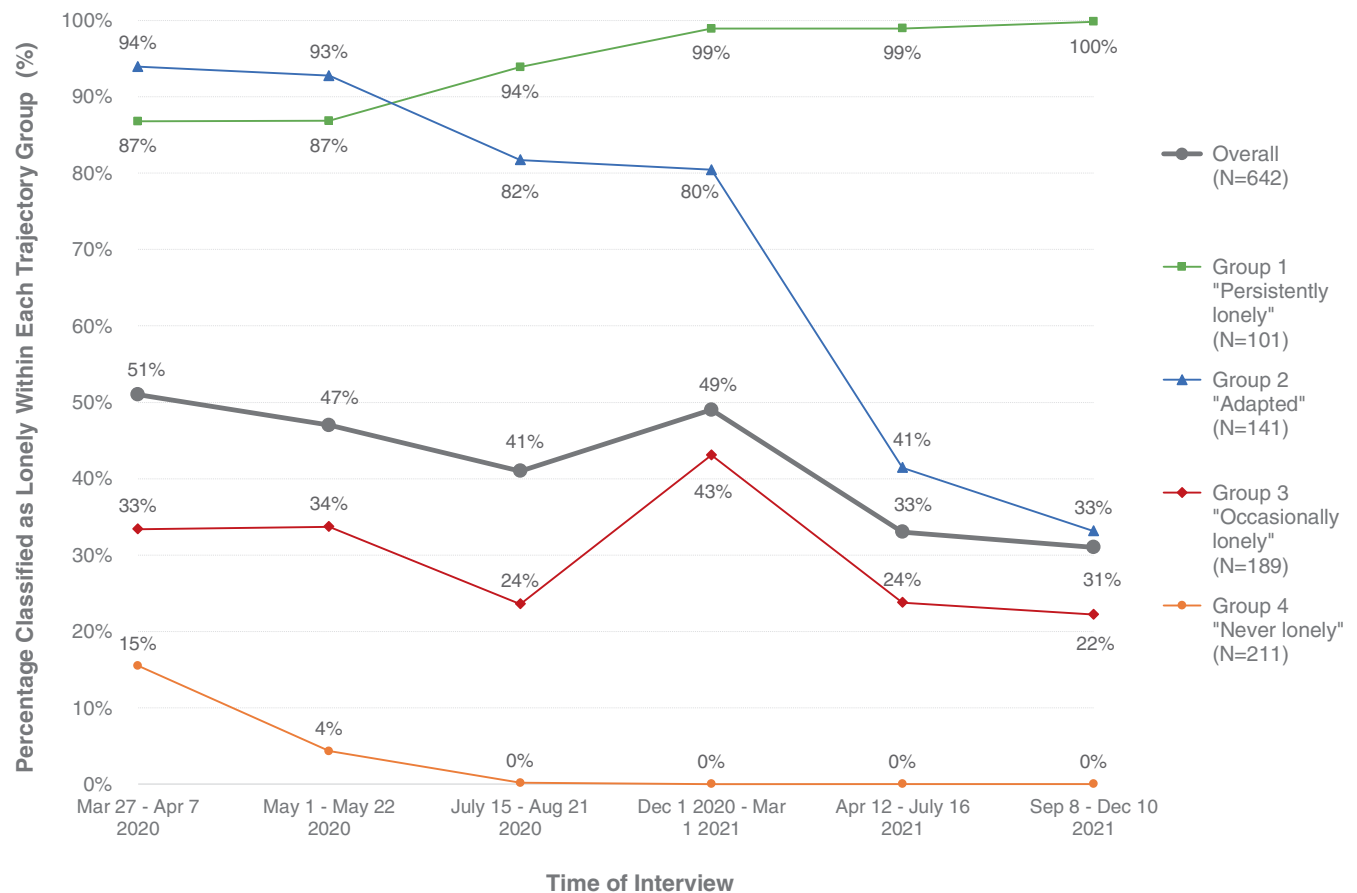


FIGURE 1 Trajectories of loneliness during the COVID-19 pandemic. Trajectory mixture models were used to identify four sub-groups taken from our overall sample ($N = 642$) following distinct loneliness trajectories. The groups included: Group 1 “Persistently Loneliness” ($N = 101$), Group 2 “Adapted” ($N = 141$), Group 3 “Occasionally Lonely” ($N = 189$), and Group 4 “Never Lonely” ($N = 211$). Loneliness was defined using the question “Over the past week, how often have you felt alone or lonely because of the coronavirus” (Responses: “Never,” “Some of the time,” “Most of the time,” or “All of the time”) with “Some of the time” or higher categorized as lonely. Each line depicts the change over time in the percentage of people within each trajectory classified as lonely.

TABLE 2 Bivariate and multivariate analyses predicting the persistent loneliness group*

	Other trajectories n = 541	Persistent loneliness n = 101	p value	aOR (95%CI) n = 518	p value
Age, mean (SD)	62.8 (11.1)	62.9 (10.1)	0.94	1.0 (0.98,1.0)	0.68
Gender			0.46		
Female	327 (60.4)	65 (64.4)		1.1 (0.6,1.8)	0.81
Male	214 (39.6)	36 (35.6)		REF	
Race/ethnicity ^a			<0.001		
Black	169 (31.7)	22 (22.2)		0.7 (0.3,1.3)	0.20
Hispanic/Latinx	92 (17.2)	36 (36.4)		2.5 (1.2,5.2)	0.01
Other ^a	15 (2.8)	3 (3.0)		1.5 (0.3,6.1)	0.61
White	258 (48.3)	38 (38.4)		REF	
Poverty level ^b			<0.001		0.003
Below poverty level	139 (25.9)	45 (44.6)		2.5 (1.4,4.6)	
Above poverty level	397 (74.1)	56 (55.4)		REF	
Education			0.55		
Less than high school	51 (9.4)	13 (12.9)		0.5 (0.2,1.1)	0.09
High school graduate	82 (15.2)	12 (11.9)		0.5 (0.2,1.2)	0.13
Some college/technical school	139 (25.7)	29 (28.7)		0.9 (0.5,1.6)	0.67
College graduate	269 (49.7)	47 (46.5)		REF	
Comorbidities ^c			0.20		
≥3 chronic conditions	342 (63.2)	57 (56.4)		1.4 (0.8,2.6)	0.22
<3 chronic conditions	199 (36.8)	44 (43.6)		REF	
Vaccination status ^c			0.96		
Vaccinated	402 (91.8)	91 (91.9)		1.2 (0.5,3.3)	0.69
Unvaccinated	36 (8.2)	8 (8.1)		REF	
Social isolation ^d			0.10		
Socially isolated	135 (31.1)	39 (39.8)		1.3 (0.8,2.1)	0.33
Not socially isolated	299 (68.9)	59 (60.2)		REF	
Household size ^e			0.01		0.06
Live alone	161 (31.1)	45 (44.6)		1.6 (0.9,2.6)	
Live with others	356 (68.9)	56 (44.5)		REF	

*Multivariate model was adjusted for the indicated variables in table as well as parent study.

^aIn the “other” group 12 participants self-identified as Asian, 6 participants self-identified as multi-racial, 9 missing race data.

^bPoverty level was defined based on the U.S. federal 2020 poverty level, five missing poverty data.

^cVaccinated individuals were defined as having received at least one dose of a COVID-19 vaccine. One hundred and five missing vaccination data.

^dSocial isolation was defined using the Duke Social Support Index. One hundred and ten missing social isolation data.

^eTwenty four missing household size data.

$p = 0.33$, respectively), and living with others (55% and 55%, $p = 0.97$, respectively).

We determined subgroups at risk for *Persistent Loneliness* using a multivariate regression model (Table 2). Hispanic/Latinx individuals were more likely to be in the “Persistent Loneliness” group than any other groups (aOR: 2.5, 95% CI 1.2, 5.2; $p = 0.01$), as were those living below the poverty level (aOR: 2.5, 95% CI 1.4, 4.6; $p = 0.003$). Social isolation, age, gender, education level,

number of comorbidities and vaccination status were not associated with persistent loneliness after multivariable adjustment.

DISCUSSION

In a prospective cohort of diverse middle age and older adults with chronic conditions, approximately 1 in

6 adults in our sample experienced persistent loneliness over 18 months of the COVID-19 pandemic. Loneliness was specifically attributed to the COVID-19 pandemic, and may reflect emotional distress surrounding disrupted social experiences with family, social networks, or feelings of belonging in the community. Pre-COVID symptoms of anxiety and depression were closely related to the risk of persistent loneliness, as was living alone, living below the poverty line, and/or identifying as Hispanic/Latinx. Notably, among adults experiencing occasional loneliness or who adapted to restrictions, the surge in infections during the second COVID-19 wave (December 2020–February 2021) was accompanied with a spike in loneliness. This is in contrast to the “Delta Wave” (summer/Fall of 2021) where there was no corresponding increase in loneliness for any group, perhaps underscoring the impact of different public health approaches to each surge, different sociopolitical climates, and the availability of the vaccine. Taken together, study findings can inform efforts to address the immediate and long-term health and social consequences for individuals with chronic conditions who may be both at higher risk of COVID-19 related complications and have social lives significantly disrupted by pandemic events.

To our knowledge, our study is the first to incorporate 2021 data into longitudinal trajectories of loneliness during the COVID-19 pandemic in the United States. Consistent with prior literature from the early months of the pandemic,^{1,2} overall rates of loneliness declined among our sample. Yet, there was a striking diversity of experiences. Approximately 1 in 3 individuals in our sample were “never” lonely, even during the “Second Wave” surge of infections, with protective factors including being married, living with others, being of higher socioeconomic status, and having relatively low levels of pre-COVID-19 anxiety and depressive symptoms. In contrast, individuals with “occasional” loneliness and those who “adapted” experienced spikes in loneliness during the second wave of COVID-19 and had a more dynamic, fluctuating experience of loneliness. In addition, our findings reveal two potentially modifiable factors associated with whether an individual would experience “persistent” loneliness, or whether they would “adapt” over time. First, pre-existing depression and anxiety was significantly different between these two groups, suggesting this may have affected coping strategies. Second, the “adapted” group had nearly half the rate of social isolation, suggesting they may have compensated through increased access to and use of phone or digital technology interaction with social networks.

Participants living under the poverty line were two fold more likely to be persistently lonely compared to other trajectory groups. This is consistent with studies

demonstrating socioeconomic status to be among the strongest predictors of loneliness prior to the pandemic and during the initial months of the pandemic.^{2,25–28} However, poverty’s role in persistent loneliness may have been amplified as the pandemic has continued. The stress and emotional burden of poverty combined with pandemic restrictions may have increased feelings of loneliness. These individuals may have lacked the economic means to stay connected with one’s social network virtually, as it would require access to technology and other measures. The use of air purifiers, high quality masks, or antigen testing prior to in-person gatherings are viable ways to reduce risk, but may be cost-prohibitive. Furthermore, individuals residing in lower-income neighborhoods may have been disproportionately impacted through reduced access to transportation (canceled public transportation and low rates of car ownership), reduced walk-ability of sidewalks, and closure of community-based activities which might impact individuals relying on public resources (i.e., adult day health centers). Residing in lower income neighborhoods may also contribute to the racial/ethnic differences observed in this study. As clinicians and public health professionals continue to encourage safe ways to gather, it is vital that access to these resources is equitable, and those with the fewest resources are provided with the most assistance. Future research should explore the relationship of neighborhood factors and area deprivation index on social experiences during the pandemic.

In addition, we found Hispanic/Latinx adults in our sample were more likely to be persistently lonely, which is consistent with research at the start of the pandemic.¹¹ Though categorizing Hispanic/Latinx into one group is limited given the diversity of this population,²⁹ there are several potential explanations. This finding may be related to disruptions in culturally important familism³⁰; maintaining distance from family may have greatly impacted feelings of loneliness among individuals in intergenerational households and accustomed to being with family, including members living abroad. Moreover, Hispanic/Latinx older adults were at substantially higher risk of becoming homebound during the pandemic which may have limited social interactions.³¹ Reductions in community-based or religious activities may have more greatly impacted feelings of loneliness compared to other groups. In addition, many Hispanic/Latinx participants in our study had limited English proficiency which may have contributed to difficulty navigating restrictions or obtaining accurate information about safe socializing. Hispanic/Latinx individuals in the United States are a highly diverse group, so further work on experiences of loneliness incorporating a qualitative component and including different subgroups is needed.

Results raise concern that existing disparities in loneliness by race/ethnicity, living situation, and socioeconomic status have been exacerbated during the pandemic, with potential short-term and long-term health implications. In the short-term, persistent loneliness is emotionally distressing, can increase the risk of depression and anxiety, and impact health behaviors related to preventive health, exercise, eating habits, or substance use. In the long-term, loneliness is linked to numerous health consequences such as functional decline, cardiovascular health, and death.^{32,33} Moreover, individual levels of pandemic privilege,³⁴ including living with others, stable income, comfort with technology, and risk from COVID-19 by age, serious illness, or race/ethnicity, may have provided a buffer to the harmful effects of COVID restrictions for some, but contributed to disparities for others.^{2,35}

Clinical and public health efforts should therefore take a proactive and coordinated approach to addressing mental and social health needs among high-risk groups. As a first step, messaging campaigns related public awareness on loneliness or multidimensional social determinants of health risk stratification tools integrated into health systems can assist in identification of individuals at risk for loneliness. Once identified, individuals should be provided resources which fit their needs, whether it is a need for more social interaction, counseling, or addressing health challenges that impact social experiences. A recent National Academy of Sciences 2020 report concluded that a robust evidence base for interventions to address loneliness is lacking.³⁶ Consequently, as we await higher quality evidence, creative solutions continue to be needed to compensate for the ongoing pandemic-related disruption of normal social interaction. Several promising interventions exist to address loneliness, many of which have received additional attention and resources during the COVID-19 pandemic. These include peer support interventions, friendship lines, technology classes, social robots or pets, intergenerational volunteers, and others³⁷⁻³⁹; many programs should be maintained or expanded. Funding aimed at improving coordination and the flow of information between local health departments, health systems and community-based organizations can aid in this effort.⁴⁰ Given current and future variants affecting policy decisions regarding physical distancing, further research should monitor the impact of persistent loneliness on longer-term health outcomes.

Our study should be recognized in the context of several limitations. First, study participants were primarily middle-age and older individuals enrolled in ongoing NIH-funded research studies in one large US city. Thus, our findings may have limited generalizability, particularly, for younger adults, those in rural areas, those

without underlying chronic conditions, those with severe cognitive impairment or sensory impairment impeding ability to participate in an interview, or individuals residing in long-term care. Second, we did not have a pre-COVID assessment of loneliness levels and so cannot make conclusions about changes in loneliness from prior to the pandemic. Third, the loneliness item used in this study was specific to loneliness due to the pandemic, and may not include other dimensions of loneliness participants experience for other reasons. Therefore, results should not be interpreted as general prevalence estimates of loneliness. Fourth, we relied on participant self-reports of loneliness attributed to the COVID-19 pandemic, which is subject to recall bias, but participants were instructed to report on their feelings of loneliness in the previous week, in order to minimize any recall bias. Additionally, our sample size limited the extent to which we could use multivariate analysis, including multinomial regression, to understand characteristics associated with clustering in different trajectories. Due to missing data on the anxiety measure, anxiety findings should be regarded as exploratory.

In conclusion, we found that loneliness declined for a majority of older adults during the pandemic in our sample, but that persistent loneliness attributed to the COVID-19 pandemic was common, particularly among individuals identifying as Hispanic/Latinx or living in poverty. Existing interventions and creative solutions which address loneliness may play an important role in easing pandemic-related suffering, and mitigating long-term mental and physical health consequences.

AUTHOR CONTRIBUTIONS

Conception and design: Ashwin A. Kotwal, Stephanie Batio, Michael S. Wolf, Kenneth E. Covinsky, Julia Yoshino Benavente, Carla M. Perissinotto, Rachel M. O'Connor.

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CONFLICT OF INTEREST

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The sponsor had no role in the design, methods, data collection, analysis, or preparation of the paper.

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