Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Perceived neighborhood cohesion buffers COVID-19 impacts on mental health in a United States sample

Jennifer W. Robinette [a,d,*], Georgiana Bostean [b,d], Laura M. Glynn [a,d], Jason A. Douglas [c,d], Brooke N. Jenkins [a,d], Tara L. Gruenewald [a,d], David A. Frederick [a,d]

[a] Psychology Department, Crean College of Health and Behavioral Sciences, Chapman University, One University Drive, Orange, CA 92866, USA
[b] Department of Sociology, Environmental Science and Policy Program, Chapman University, One University Drive, Orange, CA 92866, USA
[c] Department of Health Sciences, Crean College of Health and Behavioral Sciences, Chapman University, One University Drive, Orange, CA 92866, USA
[d] Center for Biopsychosocial Approaches to Health, Chapman University, Orange, CA, USA

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ABSTRACT

Objective: This study examined whether perceived neighborhood cohesion (the extent to which neighbors trust and count on one another) buffers against the mental health effects of the 2020 COVID-19 pandemic.
Methods: The XXX University National COVID-19 and Mental Health Study surveyed US adults ($N = 3965$; M age = 39 years), measuring depressive symptoms, staying home more during than before the 2020 pandemic, and perceived neighborhood cohesion.
Results: A series of linear regressions indicated that perceiving one's neighborhood as more cohesive was not only associated with fewer depressive symptoms, but also attenuated the relationship between spending more time at home during the pandemic and depressive symptoms. These relationships persisted even after taking into account several individual-level sociodemographic characteristics as well as multiple contextual features, i.e., median household income, population density, and racial/ethnic diversity of the zip codes in which participants resided.
Conclusions: Neighborhood cohesion may be leveraged to mitigate pandemic impacts on depressive symptoms.

1. Introduction

Since the first human infection with the new coronavirus, SARS-CoV-2, the 2020 COVID-19 pandemic has launched an unprecedented series of events. The infection rate in the United States has left many sick (Centers for Disease Control and Prevention, 2020), or fearful about their own and others' health (Wang et al., 2020; Zheng et al., 2021). Indeed, in April 2020, New York City became one of the major COVID-19 hotspots in the world, with deaths far surpassing expected seasonal baseline rates (Olson et al., 2020). The US has dealt with high number of cases relative to other countries from the start of the pandemic, but there has also been substantial variability in deaths due to COVID-19 across US regions (Heuveline and Tzen, 2021).

Furthermore, to slow the rapid spread of the virus, closures of schools, businesses, and other meeting spaces (Gostin and Wiley, 2020; Prem et al., 2020) have left many without familiar resources for socio-emotional, physical, and spiritual engagement. Physical distancing and safer-at-home orders have substantially diminished the spaces within which people carry out typical activities of daily living, contributing to short-term mental health challenges such as increased anxiety and depressive symptoms (Cao et al., 2020; Smith et al., 2020). Safer-at-home orders have led to social isolation from friends and family members for many, leading to greater feelings of loneliness which may, in turn, increase symptoms of depression (Kendrl and Perry, 2020). However, mounting research indicates that the magnitude of direct (personal threat of infection) and indirect (financial strain) effects of the COVID-19 pandemic varies across social statuses. Women, younger adults, and those with lower income levels suffered greater depressive symptoms than men, older adults, and those with higher income levels during initial (March–May 2020) phases of the COVID-19 pandemic (Zheng et al., 2021). Moreover, psychosocial factors impact variability in mental health effects, such that individuals reporting greater resiliency (e.g., strength and tenacity) also reported fewer depressive, anxiety, and somatization symptoms due to COVID-19 (Ran et al., 2020).

The pandemic and related stay-at-home orders resulted in far more time spent at home for most people, and therefore greater exposure to

* Corresponding author. Psychology Department, Chapman University, One University Drive, Orange, CA 92866, USA.
E-mail address: robinette@chapman.edu (J.W. Robinette).

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one's home and neighborhood. Thus, characteristics of those environments may have become more salient and influential on people's psychosocial well-being. The purpose of the present study was therefore to investigate whether neighborhood cohesion, specifically, may explain varying mental health impacts of the 2020 COVID-19 pandemic.

1.1. The 2020 COVID-19 pandemic in context: the Stress Process Model

The present study draws on the Stress Process Model to understand potential impacts of the 2020 COVID-19 pandemic on mental health (Pearlin et al., 1981). The primary tenets of the Stress Process Model are that stressful life events, and the chronic strains those events trigger, lead to mental health challenges through a process. This process involves the gradual depletion of personal resources. At the same time, however, support from members of one's social network and adaptive coping mechanisms may buffer the impact of undesirable life events on mental health. Extrapolating from this model, the 2020 COVID-19 pandemic can be thought of as a massive, shared undesirable event which has instigated a chronic state of fear and uncertainty (Wang et al., 2020) as well as social isolation and social distancing (Gostin and Wiley, 2020; Prem et al., 2020).

Perceived neighborhood cohesion may serve as a social resource that reduced the negative mental health impacts of some of the pandemic-related chronic strains. Although not all neighborhoods are cohesive (Caughy et al., 2001), in some neighborhoods, residents may feel a sense of cohesion with neighbors, which could serve as a social resource in several potential ways. Those who perceive their neighborhoods as cohesive may appraise the stressor (staying at home more) as less stressful, or could have better emotional and behavioral adaptations to the stressor, which in turn are associated with a less negative mental health impact (Cohen and Wills, 1985). For instance, individuals who perceive their neighborhood as cohesive may also perceive greater support availability—that they can, as an example, call on neighbors for social support (e.g., friendship, information, instrumental, and emotional support) (Cohen and Wills, 1985) during the 2020 COVID-19 pandemic and related safer-at-home orders. They may also feel less lonely, which large population-based studies have shown is a risk factor for the self-report of depressive symptoms (Cacioppo et al., 2006). Those who perceive their neighborhoods as cohesive are more likely to engage in physical activity (Quinn et al., 2019), which improves mental health (Herbert et al., 2020). Supporting the salubrious mental health effects of perceived neighborhood cohesion, a longitudinal study of older adults found that depressive symptom trajectories were more favorable among those reporting higher cohesion (Ruiz et al., 2018).

Drawing on the Model, the present study examined: (1) the mental health impact of staying at home more during the 2020 COVID-19 pandemic and (2) whether perceived neighborhood cohesion attenuates this COVID-19 impact on mental health. We follow the large literature that models perceived neighborhood cohesion as an individual-level social resource (Robinette et al., 2013) because it is measured at the individual level, and individuals within the same neighborhood could have differing perceptions of cohesion. Because large numbers of residents within each neighborhood are needed to consider perceived cohesion a neighborhood-level characteristic (not available in the dataset used here), we instead adjust for additional neighborhood-level potential confounders to examine the non-spurious effects of perceived cohesion.

1.2. Empirical support for perceived neighborhood social cohesion as a stress buffer

Greater neighborhood social cohesion is linked to better health (Dawson et al., 2019; Echeverría et al., 2008; Kim et al., 2020; Rios et al., 2012; Robinette et al., 2018). People living in more cohesive neighborhoods—those in which neighbors trust and count on one another—report fewer symptoms of depression in general (Kim et al., 2020) and are less psychosocially impacted by neighborhood structural disadvantage (Dawson et al., 2019). Perceived neighborhood cohesion also has buffering effects against a myriad of health-deleterious minor and more traumatic stressors. Although minor stressors, such as an argument with a friend, increase self-reported negative affect and physical symptoms, perceived neighborhood cohesion appears to attenuate this minor stressor-well-being association (Robinette et al., 2013). Similarly, although individuals who have recently experienced a trauma (e.g., death of a loved one, assaults, injuries) exhibit greater symptoms of post-traumatic stress disorder (PTSD), the trauma-PTSD relationship is weaker among those reporting greater perceived neighborhood cohesion (Johns et al., 2012). Moreover, adolescents living in neighborhoods perceived as more cohesive exhibited fewer symptoms of mental health or behavioral problems in response to stressful life events compared to their peers living in neighborhoods perceived as less cohesive (Kinsbury et al., 2020). These results suggest that perceived cohesion serves as a neighborhood social resource that, when available, offers potential health benefits.

Beyond these personal-level minor and traumatic experiences, perceived neighborhood cohesion is a stress buffer in the context of shared traumas, such as natural disasters (Greene et al., 2015; Hikichi et al., 2016; Le et al., 2013). In flood-prone areas of England, for example, individuals residing in communities perceived as more cohesive suffered from less psychological distress after a flood (Greene et al., 2015). Two years after the 2011 earthquake and tsunami in Tohoku, Japan, 11.4 % of survivors presented with symptoms of severe PTSD (Hikichi et al., 2016). Incident PTSD was, however, disproportionately present among individuals living in neighborhoods perceived as less cohesive before the traumatic event. Hurricane Katrina resulted in displacement of many people from their homes in the southernmost counties of Mississippi, US (Le et al., 2013). Although this displacement was associated with an increase in depressive symptoms, people who perceived they had resided in more cohesive neighborhoods before the hurricane reported fewer symptoms of depression 18–24 months after the hurricane. While the circumstances facing people in the context of the 2020 COVID-19 pandemic differ in many ways from those who have survived other shared traumas, there are fundamental similarities between such disasters and the current pandemic, such as the threat to physical health and extreme isolation from social network members.

Despite discussions about the role of social determinants of health in the evolution of the pandemic (Singh et al., 2020), few studies to-date have examined the role of perceived neighborhood cohesion (one of the social determinants of health) in buffering the mental health impacts of pandemic-related stressors. Among the first attempts to demonstrate how neighborhood social cohesion could mitigate the mental health effects of the pandemic, researchers demonstrated that residents in Wuhan who perceived their neighborhoods as more cohesive reported fewer symptoms of anxiety and depression during the 2020 COVID-19-related city lock-down (Miao et al., 2020).

1.3. The present study

This is the first study, to the authors' knowledge, to examine the associations between perceived neighborhood cohesion and time spent at home on mental health during the 2020 COVID-19 pandemic in the United States. The aims were to test the two hypotheses illustrated in Fig. 1:

1. COVID-19 impact: spending more time at home during, relative to before, the pandemic would be related to more symptoms of depression (shown with a solid line in Fig. 1); and
2. Greater perceived neighborhood cohesion would be associated with fewer symptoms of depression and would buffer (moderate) the association between spending more time at home and depressive symptoms (shown with dashed lines in Fig. 1)

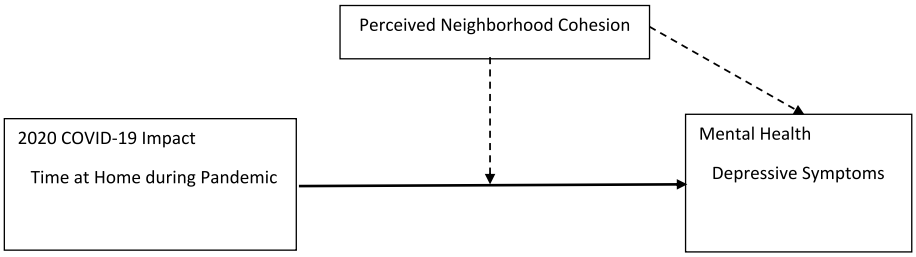

Fig. 1. Theoretical framework. *Note.* In this theoretical model, spending more time at home during the 2020 COVID-19 pandemic is predicted to be associated with more depressive symptoms. Perceived Neighborhood Cohesion is predicted to be associated with fewer depressive symptoms and to buffer the 2020 COVID-19 Impact on depressive symptoms.

2. Methods

Participants were part of the XXX University National COVID-19 and Mental Health Study. Participants were recruited from Amazon's Mechanical Turk, a widely used online panel system that allows researchers to access a U.S. set of adult users who take surveys in exchange for a nominal fee (Buhrmester et al., 2011; Kees et al., 2017; Robinson et al., 2019). Participants were paid $1.20 for taking the survey. This rate was estimated to match the federal minimum wage for participants who completed the survey efficiently in 10 min. We chose a very broad title for the survey listing that was visible to participants: "Personal Attitudes and Experiences Survey." Participants were told that the survey involves reporting about their personal attitudes, beliefs, behaviors, and demographics. This description was chosen to ensure that people interested in COVID-19 or health were not disproportionately recruited based on the advertisement. When participants clicked on the survey link, the consent form provided more information about the study. To gather data from people with a wide variety of schedules, the survey was posted several times throughout the day from Wednesday, April 22, 2020 until Sunday, April 26, 2020. The study was conducted under the XXX University Institutional Review Board.

A total of 6457 potential participants answered the question about participation consent, and 5713 people progressed through to the final question. Although Mechanical Turk allows researchers to rapidly recruit large and diverse samples, a subset of participants will click through the survey without reading the questions, which has led researchers to embed attention checks and other mechanisms for detecting inattentive responders as part of the best practices for using Mechanical Turk (Storozuk et al., 2020; Young and Young, 2019). In order to maximize the quality of the data, we used multiple strategies to ensure that participants were attending to the questions, including: multiple "trap questions" where participants were asked to answer a question with a specific response, asking the same question twice and assessing if a similar response was provided each time, identifying impossible or implausible answers (e.g., body mass index of 833), eliminating duplicate IP addresses, and directly asking participants if they completed the survey carelessly and had sped through the survey without reading questions carefully. We applied the following inclusion criteria for the survey: completed the survey, passed attention checks (e.g., click "strongly agree" on this item), reported that they had not taken this survey before, and indicated living in the U.S. As additional measures of quality-control, participants were asked, 'Should we trust your answers?' to which participants reported 'yes' or 'no.' Furthermore, participants were asked, 'How did you answer the questions?' to which participants reported 1 = 'I sped through the survey without reading most of the questions' and 2 = 'I answered most of the questions carefully.' If there were multiple entries from a duplicate IP address, only one entry from that IP address was accepted to prevent double-counting of a single individual. This process resulted in a sample of 4137 participants. We then applied two additional inclusion criteria: we eliminated participants who could not be matched to zip code-level income data and six people who identified as intersex because the sample size was not sufficient to compare the intersex group separately when including sex as a predictor in regression models. Given that only 166 people (four percent) were missing information regarding zip code-level income, we did not perform any missing data imputations (Tabachnick and Fidell, 2007). This yielded a final analytic sample size of 3965.

2.1. Measures

Depressive symptoms. The Patient Health Questionnaire-9 measures the frequency with which people experience symptoms of depression across nine items (Kroenke et al., 2001; Gilbody et al., 2007). Participants reported how routinely they experienced these symptoms in the past week (0 = Not at all, 1 = Several days, 2 = Over half the days, 3 = Nearly every day). For example, participants indicated how routinely they were "feeling down, depressed, or hopeless?" and they were experiencing "little interest or pleasure in doing things?" The items were summed with a potential score range of 0–27 ($\alpha = 0.91$), and the scale demonstrated validity for predicting major depressive disorders and depression severity (Kroenke et al., 2001).

Time at home. Participants were asked one question that they answered on a Likert-type scale (1 = Definitely disagree; 5 = Definitely agree): "I am spending much more time at home now than I did before the COVD-19 pandemic." This variable was z-scored for use in the analytic models so that regression coefficients could be interpreted as change in depressive symptoms for standard deviation increases in time spent at home.

Perceived neighborhood social cohesion. Perceived neighborhood cohesion was assessed with two items (Keyes, 1998). Participants indicated how much they agreed with the statements: "I could call on a neighbor for help if I needed it" and "People in my neighborhood trust each other." Response options included 1 = Definitely disagree, 2 = Mostly disagree, 3 = Neutral, 4 = Mostly agree, and 5 = Definitely agree. The items showed high internal consistency ($\alpha = 0.82$) and were averaged with a potential score range of 1.0–5.0, with higher scores indicating greater perceived neighborhood cohesion. This variable was z-scored for use in the analytic models so that regression coefficients could be interpreted as change in depressive symptoms for standard deviation increases in perceived neighborhood cohesion.

Covariates. Several variables known to be associated with mental health and neighborhood cohesion were included as covariates in all statistical models. Participants were asked whether they had been diagnosed with COVID-19 (0 = no, 1 = yes). Participants reported whether their 2019 household income fell within categories in increments of $10,000 US dollars (e.g., 1 = $0, 2 = $10,000, 3 = $20,000, etc.). Education was coded 1 = some high school or less, 2 = high school degree, 3 = some college, 4 = two-year degree, 5 = four-year degree, and 6 = advanced degree. Essential health and safety worker status was assessed with an item asking participants *"I work in a medical or safety "front line job" that directly exposes me to people with COVID-19 (*e.g.*, in hospital, healthcare, police officer)" (1 = Definitely Disagree, 2 = Mostly Disagree, 3 = Neutral, 4 = Mostly Agree, 5 = Definitely Agree)*. Age was coded in years. Sex at birth was coded 0 = male, 1 = female. Race/

ethnicity was dummy coded with Black, Asian, Latinx, and Other as the comparison groups to the largest category (non-Latinx White). To determine whether perceived neighborhood cohesion was related to mental health above and beyond perceived support from romantic partners, relationship status, coded as 0 = not involved with anyone, versus 1 = some romantic involvement, was also included.

Because neighborhood socioeconomic status, racial/ethnic diversity, and population density are known to be associated with neighborhood cohesion and depression (Glas et al., 2021; Hand and Howrey, 2017; Rios et al., 2012), we control for their potential confounding influence. Median household income of the zip code, gathered from the American Community Survey (ACS) five-year (2014–2018) estimates, was used as a measure of neighborhood socioeconomic status. Also included from ACS data, we followed previous work by constructing a measure of racial/ethnic diversity, which was calculated by subtracting from the total population a quantity representing the sum of squared proportions of individual identifying as non-Latinx White, non-Latinx Black, non-Latinx Asian, non-Latinx Other, and Latinx (Subica et al., 2018). We further adjusted for a measure of population density from ACS data which was constructed by dividing the total population by square kilometers (Manson et al., 2020). Each of these three contextual covariates was standardized so that coefficients could be interpreted as the change in depressive symptoms for every one-standard-deviation increase in the contextual covariate.

2.2. Statistical analyses

The primary aim of the present analyses was to investigate whether the hypothesized mental health outcomes associated with the 2020 COVID-19 pandemic would differ for individuals who perceived their neighborhoods as more or less cohesive. Due to the sample design, there was insufficient clustering of participants at the zip code level to warrant a multi-level model. As such, a series of linear regressions were conducted to examine hypothesized associations. In the first model, depressive symptoms were regressed on perceived neighborhood cohesion and the COVID-19 Impact (spending more time at home during the pandemic). This first model evaluated whether spending more time at home would be related to more depressive symptoms (Hypothesis 1), and whether perceiving the neighborhood as more cohesive would be related to fewer depressive symptoms (Hypothesis 2). Covariates in this model included diagnosis with COVID-19, household income, educational attainment, essential health care worker status, age, sex at birth, race/ethnicity, and relationships status. In addition, several contextual indicators that are implicated in the development neighborhood cohesion are included as covariates, including median household income, population density, and racial/ethnic diversity of the respondent's zip code. In Model 2, an interaction term between perceived neighborhood cohesion and spending time at home during the pandemic assessed the hypothesized buffering effect of perceived neighborhood cohesion on depressive symptoms (Hypothesis 2). To ensure that any support for the key hypothesis (perceived neighborhood cohesion moderates the link between time at home and depression) is driven by perceived neighborhood cohesion, and not by contextual correlates of cohesion, we also included interactions between each of the contextual features (median household income, population density, racial/ethnic diversity) with time at home in Model 2 (Keller, 2014). To visualize the interaction, predicted levels of depressive symptoms are shown by perceived neighborhood cohesion and time at home in Fig. 2. Furthermore, a simple slopes analysis was performed to determine potential thresholds above where, in the five-point perceived neighborhood cohesion scale, the effect of spending more time at home during the 2020 COVID-19 pandemic on depressive symptoms was attenuated.

3. Results

Participant demographics. Table 1 provides a description of the variables in the analytic models and comparisons to US averages, where available. The ages of participants ranged from 18 to 84, with 96% of the sample falling between 18 and 65. Participants came from all 50 US states.

Hypothesis 1. Spending more time at home would be related to more symptoms of depression. Table 2 shows the results of the models examining depressive symptoms concerning spending more time at home during the pandemic, perceived neighborhood cohesion, and their interaction as well as all covariates. Providing support for Hypothesis 1, people who reported staying at home more during than before the pandemic reported more symptoms of depression ($b = 0.41$, $SE = 0.10$, $p < 0.001$, 95 % CI: 0.21, 0.60).

Relationships with covariates. Individuals who had been diagnosed with COVID-19, with lower income, with essential health care worker status, younger age, and female sex at birth reported more symptoms of depression. Consistent with pre-COVID-19 national trends (Weinberger et al., 2018), non-Latinx Whites reported more symptoms of depression than Latinx, non-Latinx Blacks, and non-Latinx Asians. Individuals residing in higher income and more densely populated zip codes reported more symptoms of depression.

Hypothesis 2. Greater perceived neighborhood cohesion would be associated with fewer depressive symptoms and would buffer against spending more time at home in relation to depressive symptoms. In support of Hypothesis 2, individuals who perceived their neighborhoods as more cohesive reported fewer symptoms of depression than those who report lower neighborhood cohesion ($b = -1.29$, $SE = 0.10$, $p < 0.001$, 95 % CI: −1.49, −1.10; Table 2). Despite that the interaction term between perceived neighborhood cohesion and time spent at home was marginally statistically significant ($b = -0.17$, $SE = 0.09$, $p = 0.061$, 95 % CI: −0.35, 0.01), review of Fig. 2 depicted a pattern where time at home was more strongly related to depressive symptoms at successively lower levels of perceived neighborhood cohesion. A close inspection of the interaction pattern through simple slope analysis indicated that groups of individuals at average (coef. = 0.35, $SE = 0.10$, $p < 0.001$), one standard deviation below average (coef. = 0.52, $SE = 0.13$, $p < 0.001$), and two standard deviations below average (coef. = 0.69, $SE = 0.20$, $p < 0.001$) on the perceived neighborhood cohesion scale reported significantly more symptoms of depression at higher levels of time spent at home. Conversely, among groups of individuals at both one (coef. = 0.18, $SE = 0.15$, $p = 0.227$) and two (coef. = 0.00, $SE = 0.22$, $p = 0.984$) standard deviations above the average perceived neighborhood cohesion, there was no significant association between time spent at home and depressive symptoms.

4. Discussion

International spread of the new SARS-CoV2 virus in late 2019/early 2020 generated global concerns about health. In this study of almost 4000 U.S. adults, we observed a relationship between mental health and an aspect of the 2020 COVID-19 pandemic, namely from being confined to one's home for a lengthy period of time due to safer-at-home orders (see Table 2). Our findings are among the first, to our knowledge, to document the mental health protective effects of perceived neighborhood cohesion in the context of the 2020 COVID-19 pandemic in the US. Not only did individuals who perceived their neighborhoods as more cohesive report fewer symptoms of depression during the pandemic, but higher levels of perceived neighborhood cohesion buffered against spending more time at home concerning depressive symptoms. This was most clearly evident in the simple slope analysis, where among people spending the most time at home during the pandemic, average scores on the scale of depressive symptoms differed by about seven scale points when comparing individuals in the highest (5) and lowest (12) cohesive areas, respectively (see Fig. 2). When situating these scores into categories that classify individuals into minimal, mild, moderate,

Table 1
Description of analytic sample ($N = 3965$).

	Sample Means (*sd*)	US (2019 1-Year Estimates)
Depressive Symptoms (range 0–27)	7.70 (6.58)	
Time at Home (range 1–5)	4.33 (1.04)	
Neighborhood Cohesion (range 1–5)	3.30 (1.09)	
Diagnosed with COVID-19		
Yes	2.34 %	
No	97.65 %	
2019 Household Income		
Less than $10,000	1.29%	5.79%
$10,000–29,999	14.08%	16.36%
$30,000–49,999	20.34%	16.28%
$50,000–99,999	41.52%	30.20%
$100,000–149,999	15.39%	15.72%
$150,000+	7.38%	15.65%
Education – Bachelor's or Higher	60 %	33.1 %
Health Care Worker Status (range 1–5)	1.40 (1.00)	
Age	39.11 (13.35)	38.5
Sex (% Male)	43 %	49.2 %
Race/Ethnicity		
non-Latinx White	75 %	60 %
non-Latinx Black	9 %	12.4 %
Latinx	5 %	18.4 %
non-Latinx Asian	7 %	5.6 %
non-Latinx Other	4 %	1.2 %
Relationship Status		
Yes	70 %	
No	30 %	
Zip Code		
Median Income	$67,291 ($27,187)	
Racial/Ethnic Diversity	0.43 (0.19)	
Population Density	572.89 (2279.99)	

Notes: Depressive symptoms, and time at home, and perceived neighborhood cohesion are coded such that higher numbers indicate greater levels of these factors. Health care worker variable coded 1–5 (1 = definitely disagree to 5 = definitely agree) to indicate whether respondent works in a medical or safety job. Relationship status indicated whether respondent was "not involved" with anyone (No) or had some romantic involvement (Yes); there is no comparable national measure for this item to our knowledge, therefore we do not present US estimate in the table. Income data from the American Community Survey (ACS) reflects household income in the past 12 months in 2019 inflation-adjusted dollars. ACS data for population density is the total population divided by land area in squared kilometers, and data for racial/ethnic diversity is the total population minus the sum of the squared proportions of non-Latinx Whites, non-Latinx Blacks, non-Latinx Asians, non-Latinx Others, and Latinx.

moderately severe, and severely depressed (Kroenke et al., 2001), this separates individuals in the present study into mildly depressed and moderately depressed groups by levels of highest and lowest cohesion, respectively.

4.1. *Perceived neighborhood cohesion in the context of the 2020 COVID-19 pandemic*

The stress buffering hypothesis argues that, in addition to general benefits of companionship, greater levels of social support from friends and family offsets the pernicious effects of stress on well-being (Kessler and McLeod, 1985). Perhaps ironically, the 2020 COVID-19 pandemic not only served as an international chronic stressor as people feared for their health and safety, but simultaneously limited peoples' access to friends and family, at least regarding in-person interactions. Inadequate access to social support, or perceiving oneself as lacking needed support, has well-established links to poor mental health (Kessler and McLeod, 1985).

Support can come from many sources, however, and neighbors who may have been more accessible during the pandemic than friends and

Table 2
Linear regressions predicting depressive symptoms by time at home during the 2020 COVID-19 pandemic and perceived neighborhood cohesion, $N = 3965$.

	Model 1		Model 2	
	b (*SE*), *p*	95 % CI	*b* (*SE*), *p*	95 % CI
Time at Home	0.41 (0.10), <0.0001	0.21, 0.60	0.41 (0.11), <0.0001	0.20, 0.62
Perceived Neighborhood Cohesion	−1.29 (0.10), <0.0001	−1.49, −1.10	−1.30 (0.10), <0.0001	−1.50, −1.11
Time at Home × Neighborhood Cohesion Interaction			−0.17 (0.09), 0.061	−0.35, 0.01
Diagnosis with COVID-19	3.97 (0.64), <0.0001	2.71, 5.22	3.94 (0.64), <0.0001	2.68, 5.19
Household Income	−0.14 (0.27), <0.0001	−0.20, −0.09	−0.14 (0.03), <0.0001	−0.20, −0.09
Education[a]				
High School	−2.01 (1.38), 0.145	−4.71, 0.70	−2.06 (1.38), 0.135	−4.76, 0.64
Some College	−1.08 (1.36), 0.426	−3.74, 1.58	−1.18 (1.36), 0.386	−3.83, 1.48
Two-Year Degree	−2.58 (1.37), 0.060	−5.27, 0.11	−2.66 (1.37), 0.053	−5.35, 0.04
Four-Year Degree	−2.11 (1.35), 0.118	−4.76, 0.54	−2.19 (1.35), 0.104	−4.84, 0.45
Advanced Degree	−2.16 (1.36), 0.113	−4.81, 0.51	−2.21 (1.36), 0.105	−4.88, 0.46
Health Care Worker Status	1.30 (0.10), <0.0001	−1.11, 1.50	1.28 (0.10), <0.0001	1.08, 1.48
Age	−0.10 (0.01), <0.0001	−0.11, −0.08	−0.10 (0.01), <0.0001	−0.11, −0.08
Female	1.47 (0.20), <0.0001	1.09, 1.85	1.47 (0.20), <0.0001	1.09, 1.86
Race/Ethnicity[b]				
Latinx	−1.43 (0.45), 0.002	−2.31, −0.54	−1.39 (0.45), 0.002	−2.28, −0.50
Non-Latinx Black	−1.29 (0.35), <0.0001	−1.97, −0.62	−1.29 (0.34), <0.0001	−1.96, −0.62
Non-Latinx Asian	−1.28 (0.39), 0.001	−2.04, −0.52	−1.23 (0.39), 0.002	−1.99, −0.47
Other	−0.41 (0.40), 0.404	−1.39, 0.56	−0.40 (0.50), 0.425	−1.37, 0.58
In a Relationship[c]	−0.01 (0.22), 0.966	−0.44, 0.42	−0.03 (0.22), 0.907	−0.46, 0.40
Zip Code-Level				
Median Income	0.22 (0.10), 0.028	0.02, 0.42	0.22 (0.10), 0.034	0.02, 0.42
Racial/Ethnic Diversity	−0.04 (0.10), 0.697	−0.24, 0.16	−0.05 (0.10), 0.623	−0.25, 0.15
Population Density	0.11 (0.05), 0.022	0.02, 0.21	0.12 (0.05), 0.015	0.02, 0.22
Time at Home × Median Income			−0.05 (0.11), 0.643	−0.27, 0.16
Time at Home × Racial/ Ethnic Diversity			−0.11 (0.09), 0.259	−0.29, 0.08
Time at Home × Population Density			−0.10 (0.05), 0.050	−0.21, 0.00

*p < 0.05; **p < 0.01; ***p < 0.001.
[a] Compared to Less than High School.
[b] Compared to non-Latinx Whites.

[c] Compared to not in a romantic relationship.

family who live in different neighborhoods appeared to have provided mental health benefits to some individuals in the present sample. These results support the Stress Process Model (Pearlin et al., 1981) which argues that life events and related chronic strain relates to mental health differentially across individuals varying in their access to resources, and in this case, perceived neighborhood cohesion. In the present study, sheltering at home during the pandemic was not related to self-reported depressive symptoms among individuals who viewed their neighborhoods as cohesive. Only for those who felt neutral about, or disagreed with statements about cohesion in their neighborhoods was there a significant relationship between sheltering at home and self-reported depressive symptoms. Other reports have demonstrated the psychosocial value of perceived neighborhood cohesion above and beyond the value of perceived support from friends, family, and spouses in offsetting the impact of stressful events on peoples' well-being (Robinette et al., 2013). Results of the present study suggest further that, during times when social support from members of one's usual social networks are inaccessible, support from neighbors not only remains, but may alleviate some of the burdens related to a local, national, and international crisis.

4.2. Perceived neighborhood cohesion as a pandemic unfolds and beyond

The ability to re-envision and reintegrate into society after extreme social distancing may be partially fueled by the social infrastructure that existed prior to the economic, social, and psychological shock presented by the 2020 COVID-19 pandemic (Madsen and O'mullan, 2016). Economic or other resources and aid from federal, state, and local authorities may be delayed, insufficient, or too finite to comprehensively repair daily life to a degree of familiarity with which members of society will be comfortable (Norris et al., 2008). Meanwhile, researchers have long been aware of the benefits of collective efforts to establish and maintain optimal environments (Sampson et al., 1997). Perhaps the most sustainable efforts to recreate a culturally familiar, yet revitalized society will be enabled by members of communities with a history of trust and accountability. For example, for residents of select New York and New Jersey neighborhoods, the 2012 Superstorm Sandy yielded devastating outcomes (Cagney et al., 2016). Those who perceived higher levels of neighborhood cohesion, however, also reported more perceived natural disaster preparedness and confidence in community recovery after natural disasters than those in less cohesive neighborhoods.

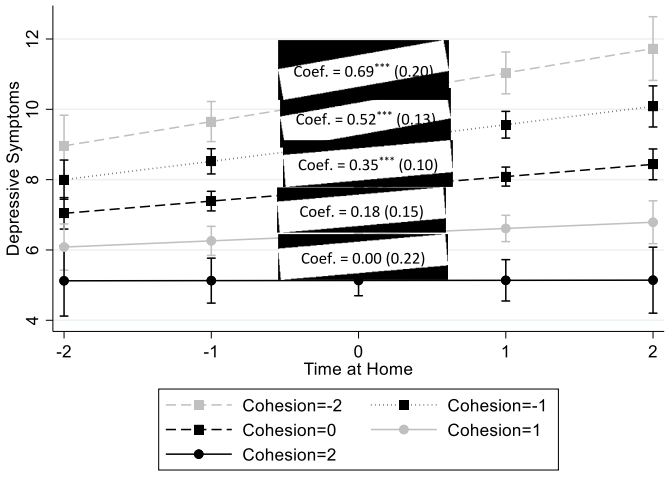

Fig. 2. Interaction between mean levels of perceived neighborhood cohesion and mean levels of time spent at home during the spring 2020 COVID-19 pandemic on depressive symptoms with simple slope coefficients among a United States sample of adults, $N = 3965$.

4.3. Study limitations

This is among the very few studies to establish an association between neighborhood cohesion and mental health in the US, 2020 COVID-19 pandemic context, but it is not without limitations. First, while the sample size is large, it is not a probability sample, which somewhat limits generalizability of these results. Our sample is similar to the US average in terms of age, but overrepresents female respondents, those with higher education, those who are non-Latinx White or Other race/ethnicity, and underrepresents those who are Latinx or non-Latinx Black. Despite some evidence that the data quality when using MTurk is at least as good as that from student and professional sample pools (Buhrmester et al., 2011), the utilization of a convenience sample limits our ability to make inferences to the US population. In addition, the online data collection method may have yielded a selective sample of respondents, underrepresenting those without internet access or who are less comfortable with technology. Third, while longitudinal studies provide support for the notion that neighborhood cohesion is causally associated with mental health (Moore et al., 2016), this study's cross-sectional design allows us to establish associations, but not causality. The measures used here are all self-reported, which may introduce recall and other types of response bias. It is possible more members of one's social network have been infected with the virus than were reported, and if more reliable information were available to participants, we expect we would have observed stronger support for the hypothesis regarding knowing people with COVID-19 and depressive symptoms. Finally, and not unlike most other neighborhoods-health studies (Pickett and Pearl, 2001), the effect sizes representing the perceived neighborhood cohesion buffering effect was small in the present study. That said, we also argue that the ability to distinguish those who were mildly depressed from those who were moderately depressed in the present sample, very shortly after the start of the 2020 COVID-19 pandemic no less, is not without important clinical implications.

5. Conclusions

COVID-19 presented challenges in 2020 that shrunk the geographic space within which people carry out their daily lives. As such, neighbors living within the same geographic space were among the primary subgroups of individuals within which in-person interactions occur. These interactions may have involved the exchange of informational, socioemotional, and other resources, particularly among members of neighborhood subgroups with a higher degree of trust and accountability. Conversely, this exchange may have been thwarted among those who perceived they were embedded in neighborhoods lacking in cohesion. While the lack of pre-pandemic data precludes us from examining whether the pandemic and stay-at-home orders altered neighborhood cohesion, our findings do provide evidence that people perceiving more cohesion in their neighborhoods were faring better than others in terms of mental health during the 2020 COVID-19 pandemic. This finding further suggests that efforts to increase cohesion among neighbors, the people to which individuals had greatest in-person access, may flatten the curve of mental health problems observed worldwide as the COVID-19 pandemic unfolded. To optimize preparedness for future shocks, efforts to further cultivate and increase levels of neighborhood cohesion may result in greater community resilience (Madsen and O'mullan, 2016), as informational exchange among neighbors may facilitate bartering of goods and socioemotional support, for example.

Beyond the 2020 COVID-19 pandemic, efforts to build strong communities of individuals who trust and count on one another may assist in preparing those communities and the residents within them for future shocks. Such efforts may involve neighborhood programs that encourage information exchange such as the presence of individuals with first response training to combat illness, physical resource bartering to prevent inadequate access to essential products and goods, and a

system of volunteer services to balance individual needs, strengths, and vulnerabilities within the neighborhood.

Author statement

Jennifer W. Robinette: Conceptualization, methodology, formal analysis, writing-original draft, funding acquisition. **Georgiana Bostean:** Conceptualization, methodology, writing- original draft, funding acquisition. **Laura Glynn:** Methodology, writing-review and editing, funding acquisition. **Jason Douglas:** Conceptualization, writing-review and editing, funding acquisition. **Brooke Jenkins:** Formal analysis, methodology, writing-review and editing, funding acquisition. **Tara Gruenewald:** Conceptualization, methodology, writing-review and editing, funding acquisition. **David Frederick:** Data curation, methodology, formal analysis, writing- review and editing, funding acquisition.

Declaration of competing interest

None.

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