Social Science & Medicine 287 (2021) 114361

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Individual and community social capital, mobility restrictions, and psychological distress during the COVID-19 pandemic: a multilevel analysis of a representative US survey☆

James Laurence [a,b], Harris Hyun-soo Kim [c,*]

[a] Cathie Marsh Institute for Social Research, University of Manchester, UK
[b] The Economic and Social Research Institute, Ireland
[c] Ewha Womans University, Department of Sociology, Seoul, Republic of Korea

ARTICLE INFO

Keywords:
COVID-19
Mobility restrictions
Individual social capital
Community social capital
Psychological-distress

ABSTRACT

This paper explores the role of social capital in mitigating the mental health harms of social/mobility restrictions instigated in the wake of the COVID-19 pandemic. We test whether: (a) social capital continued to predict lower mental distress during the pandemic; and (b) whether social capital buffered (moderated) the harm of social/mobility restrictions on psychological distress. In addition, we test the level at which social capital mitigation effects operated, i.e., at the individual- and/or contextual-level. To do so, we apply multilevel models to three waves of the COVID-19 Household Impact Survey consisting of probability samples of U.S. adults (with the average interview completion rate of 93%). In a novel approach, we explore two modes of capturing contextual social capital: aggregated individual-level survey responses and independently measured social capital indices (SCIs). Findings show that at the individual level social capital was associated with lower psychological distress. It also buffered the harm of restrictions: increasing restrictions had a weaker effect on distress among individuals interacting with neighbors more frequently. Importantly, mitigating processes of contextual social capital appeared conditional on how it was measured. Using aggregated survey responses, contextual social capital had no direct effect on distress but exerted an additional buffering role: individuals in counties with higher average neighbor-interaction experienced a weaker impact of restrictions. Using the independent SCI measures, we found county social capital reduced distress. However, its negative effect on distress becomes increasingly weaker the more restrictions an individual reported: where individuals reported lower restrictions, higher county SCI reduced distress; however, where individuals reported higher restrictions, higher county SCI had no effect on distress. More restrictive environments thus cut individuals off from the benefits of higher county social capital as measured using the SCI.

1. Introduction

The novel coronavirus (COVID-19) pandemic has wreaked havoc around the world, leaving a trail of ruined economies and public health catastrophes (Bastiampillai et al., 2020). In desperate attempts to stem the spread of the virus, governments imposed social/mobility restrictions on their citizens, albeit with varying degrees of success (Conor, 2020). A growing body of research shows that the emergence of COVID-19, and attendant restrictive-policies, has profoundly affected people's daily lives, particularly their mental health (Pietrabissa and Simpson, 2020). According to systematic reviews, the psychological impact of self-isolation can be both severe and long-term, with symptoms ranging from confusion, anger, anxiety, and depressive symptoms to post-traumatic disorder (Brooks et al., 2020; Rogers et al., 2020).

Indeed, depression has risen globally since the outbreak, associated with physical-distancing mandates and resulting isolation (Melo and Soares, 2020). However, contrary to initial expectations, COVID-19 has not been a "great equalizer" (Mein, 2020) affecting everyone irrespective of personal characteristics, such as financial status or race/-ethnicity. Rather, certain segments of the population have been much more vulnerable (Hooper et al., 2020; Kim and Laurence, 2020; Wright et al., 2020; Wu et al., 2020), thereby exacerbating pre-existing

☆ Author contributions are equal.

* Corresponding author.
E-mail address: harrishkim@ewha.ac.kr (H.H.-s. Kim).

https://doi.org/10.1016/j.socscimed.2021.114361
Received 14 June 2021; Received in revised form 29 August 2021; Accepted 31 August 2021
Available online 3 September 2021

social-inequalities (Raisi-Estabragh et al., 2020; Yaya et al., 2020). While recognizing the importance of the socioeconomic gradient in mental health, this study shifts the focus to a topic receiving less attention: the role of social capital in the uneven distribution of the pandemic's harmful effects.

Fields from sociology to epidemiology recognize social capital as a key source of 'resilience', lessening the impact of stressors in people's lives (Putnam, 2000; Bonanno, 2004; Ledogar and Fleming, 2008). Social capital is especially important during "extraordinary times" (*see* Kawachi and Subramanian, 2006; Tsuchiya et al., 2017; Ye and Aldrich, 2019), such as natural disasters or (potentially) during the contemporary public health crisis. As people undergo lockdowns and other restrictive measures, their normal routines are disrupted, if not entirely replaced, preventing them from interacting with others (coworkers, friends, family) who constituted their primary social networks during "ordinary times". As a result of declining network-ties and group-affiliations, social capital has become more limited and, by virtue of its scarcity, potentially more valuable (Borkowska and Laurence, 2020). Ironically, as people experience physical-distancing mandates and diminishing social capital, local social ties may have become increasingly important for psychological protection against the stressors of the pandemic (Pitas and Ehmers, 2020).

In the U.S., as elsewhere, depression has risen since the onset of the pandemic (Daly et al., 2021). However, not everyone has experienced this impact equally; a critical question is why. We propose that unequal access to social capital may partly account for the unequal distribution of harm to mental wellbeing during the pandemic. The present study is thus motivated by the following question: does social capital, measured at individual *and* contextual (community) levels, provide a buffer against the harmful effect of social/mobility restrictions intended to curb the coronavirus disease? Using a (pooled cross-sectional) probability sample of U.S. respondents, we provide evidence on how individual/contextual stocks of social capital are related to psychological distress during the coronavirus crisis.

1.1. Social capital and mental health

Since its introduction into the interdisciplinary literature in the 1990s, social capital has become a powerful conceptual tool, with dozens of systematic reviews (Shiel et al., 2020). As a heuristic device, it offers valuable insights into social determinants of health (for reviews, *see* Ehsan et al., 2019; Ehsan and De Silva, 2015; Villalonga-Olives et al., 2018). Despite its analytic value, the concept has received criticism (Saegert and Capiano, 2017). One of the most salient is the lack of consensus on the proper unit of conceptualization and operationalization. That is, it remains unresolved whether social capital should be viewed as a contextual or individual property (Poortinga, 2006; De Clercq et al., 2012; Ferlander, 2007; Lagaert et al., 2021). This issue has led scholars to conclude that the literature has been dominated by "the hegemony of the communitarian approach" (Moore et al., 2005) or that there are "two meanings of social capital," one defined at the individual (micro) level and another at the contextual (macro) level (Portes, 2000).

Individual and contextual forms of social capital gauge qualitatively distinct aspects of social-life and environment (De Silva et al., 2005; Kawachi et al., 2008). From a micro, or network, perspective, some studies conceptualize social capital as a "private good" by focusing on the health benefits of *particularistic* social relationships, interactions, and participation measured exclusively at the individual-level (for review, *see* Smith and Christakis, 2008; Ertel et al., 2009; Gilbert et al., 2013; Perkins et al., 2015). Taking a more macro-approach, others conceptualize it as a "public good," emphasizing the *communal* benefits of "neighborhood" cohesion, attachment, and belongingness (Carpiano and Hystad, 2011; Elliott et al., 2014; Green et al., 2019; Hikichi et al., 2020; Hoogerbrugge and Burger, 2018; Maass et al., 2016; Nakagomi et al., 2020). Social capital has also been characterized in terms of its bonding, bridging, and linking functions (Aldrich and Meyer, 2015; Szereter and Woolcock, 2004).[1]

Social capital measured at the contextual level refers to resources available via membership in a broader community, which can generate, for example, "community resilience" during times of crisis (Aldrich and Meyer, 2014). Neighborhood residents can benefit from social cohesion and collective efficacy, i.e., a group's willingness/ability to pursue a common goal, co-operate and help one another (Sampson, 2003; for review, *see* Butel and Braun, 2019). In comparison, individual social capital refers to concepts such as one's network size, frequency of interpersonal communication, and informal social engagement. Theoretically, the two types or levels of social capital can operate independently of one another. A social hermit may live in a geographic area rich in collective social capital. Conversely, a very well-connected individual could reside in a place where most other residents remain socially fragmented with low group-attachment or sense of belonging. Suffice to say, the debate persists concerning how social capital should be understood and measured in relation to health outcomes (Moore and Carpiano, 2020).

While the distinctiveness of individual versus contextual social capital is well-recognized, research that incorporates both measures remain limited, making it empirically difficult to analyze their respective importance (Mohnen et al., 2015). In this study, we treat social capital as properties of both actors and places by capturing individuals' own reported level of social capital (e.g., their frequency of interaction with neighbors) and the contextual-level of social capital in their wider area (e.g., aggregate frequency of neighbor-interaction in their area). We also explore alternative ways of capturing contextual social capital by drawing on two unique sources of data. In constructing "community social capital," researchers largely average individual-responses across higher-level units (e.g., Hoogerbrugge and Burger, 2018; Nieuwenhuis, 2020; Yamaguchi et al., 2019). This methodological strategy, though widely practiced, has been questioned on grounds of accuracy (Lagaert et al., 2021). Since high mobility may result in measures that are poor in internal consistency, some studies rely on key informants rather than the residents (Fahmi et al., 2019; Hardyns et al., 2015). Another, perhaps more critical, issue is endogeneity. When community social capital (e.g., "neighborhood trust") is constructed by averaging respondents' reports of trust, models looking at its relationship with health outcomes can be biased to the extent that reverse causation exists between the two units of measurement. Drawing causal inference hence demands examining the effects of *pre-existing* social capital captured prior to measuring health outcomes, which is largely unmet in research (Frankenburg et al., 2012; Zhanow et al., 2019).

1.2. Study aim and hypotheses

The present study examines how, and to what extent, individual/contextual forms of social capital are related to psychological distress during the coronavirus pandemic; in particular, how far they buffer the psychological harms of social/mobility distancing measures. Studies show that social capital can protect against stressors, such as natural disasters (Aldrich and Meyer, 2014) or socioeconomic hardships (Moore and Carpiano, 2020), and is an "essential element of resilience" (Story et al., 2020), providing absorptive, adaptive, and transformative capacity for communities (cf. Aldrich and Meyer, 2015). Accordingly, social capital may have played a key role in resilience during the pandemic. We thus ask if, and how, access to *individual* social capital and/or *community* social capital played a protective role for Americans' mental health. Given the known harm that social-distancing restrictions have caused, we specifically investigate whether social capital,

[1] Bonding refers to horizontal connections among similar others; bridging refers to horizontal connections among dissimilar others; linking refers to vertical ties to those in authority or with power. In our study, data limitations prevent us from explicitly considering each of them.

operationalized at two distinct levels, has mitigated their impact on psychological distress.

Based on the foregoing discussion, we develop the following hypotheses. Since the outbreak, people (Americans) have been subjected to policies that sharply limit their mobility, leading to isolation. As the basic premise of our study, we first hypothesize that *individuals who experience more restrictions in their everyday life will be more psychologically distressed* (H1). As previous studies show, social capital can reduce the harmful effects of isolation/loneliness. If so, then where social capital has persisted, it should be of significant value during a pandemic defined, first and foremost, by reduced interpersonal interaction. That is, in view of distancing-measures contracting wider social networks, our next hypothesis states: *people who report more individual-level social capital during the pandemic will report lower levels of distress* (H2).

To examine whether social capital may have, in addition, buffered (that is, moderated) the impact of social/mobility restrictions on mental health, we further anticipate an interaction-effect between restrictions and social capital. That is, in addition to a direct-effect, access to more social capital ought to exert a buffering-effect, being particularly important for individuals experiencing higher social/mobility restrictions. This leads to our third hypothesis: *the impact of restrictions on distress will be weaker among those who report more individual-level social capital, i.e., individual-level social capital will negatively moderate the positive association between restrictions and distress* (H3). H2/H3 are based on conceptions of social capital as an individual-level resource. As discussed, social capital is also conceptualized as a property of communities and, even adjusting for an individual's reported social capital, the levels of social capital in the wider context should be beneficial to them. As such, consistent with the existing scholarship, we hypothesize that *individuals who live in places with higher aggregate stocks of social capital will report lower levels of distress* (H4). Furthermore, based on the idea that individuals may also derive benefits from aggregate stocks of social capital in an area, we expect an interaction-effect involving social/mobility restrictions and, this time, contextual social capital. More specifically: *the impact of restrictions on depression will be weaker among those who live in places with higher aggregate stocks of social capital, i.e., community-level social capital will negatively moderate the positive association between restrictions and distress* (H5).

Increasingly, scholars have recommended the use of "independent measurement methods" (Hardyns et al., 2015) for measuring community social capital that are not based on aggregating respondents' responses (see Lagaert et al., 2021). We heed this call by utilizing two unique information sources—first, a microdata file consisting of the outcome measure (psychological distress) and respondents' own assessments of social capital; and second, an *independent* dataset that predates the microdata containing a comprehensive set of social capital indices across the US counties. Based on the first, we follow the conventional method of aggregation in operationalizing community social capital. Then, using the second source, our study provides alternative findings that seek to minimize, though not resolve, problems of simultaneity/endogeneity. By juxtaposing two divergent sets of results, we offer a nuanced and fuller understanding of the relationships between individual social capital, community social capital, and mental health during the pandemic, alongside key contributions to the field of health and social capital.

2. Data and methods

Data are drawn from two independent sources. First, at the individual-level, we use three waves (W1–W3) of the COVID-19 Household Impact Survey ("COVID Impact Survey"), fielded, respectively, in April (20–26), May (4–10), and June (1–8) of 2020. Data collection was completed by NORC (National Opinion Research Center) at the University of Chicago. The version of Covid Impact Survey analyzed here provides estimates of the US adult household population for 18 regional areas including 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh). The sampling frame is based on an extract of the U.S. Postal Service delivery-sequence file, covering approximately 97% of the American household-population. A special user agreement with NORC provided access to restricted data with the 4-digit FIPS (Federal Information Processing Standard Publication) geocodes at the *county* level. For the analysis, we pooled the data across W1 (N = 7467; completion rate = 92.7%)), W2 (N = 7420; completion rate = 93.3%), and W3 (N = 6082; completion rate = 92.5%). 8% of respondents had missing values on at least one variable used. After listwise deletion, the effective sample contains 19,198 respondents nested in 800 counties. To test for bias from within-case missingness we undertook several multiple-imputation approaches,[2] which produced substantively unchanged findings. Thus, we report non-imputed results here. Further details on the sampling procedures can be found at the repository (https://www.covid-impact.org/results).

For the community social capital measure, we take advantage of unique data from the Social Capital Project ("The Geography of Social Capital in America" study) commissioned by the US Congress (Joint Economic Committee). Using various administrative/survey data (conducted prior to the COVID Impact Survey in 2020) and by benchmarking Putnam's (2000) book *Bowling Alone* as well as the Penn State Index, this multi-year project provides a set of alternative indices for "community social capital" across US counties (explained below in detail). The raw data was retrieved from the Joint Economic Committee (https://www.jec.senate.gov/public/index.cfm/republicans/2018/4/the-geography-of-social-capital-in-america). Technical information on the index construction is provided in the Appendix of the Social Capital Project Report (Joint Economic Committee, 2018).

2.1. Outcome measure

Our dependent variable, *Psychological distress*, is based on answers to a battery of negative feelings and stressful experiences during the past week of the COVID-19 pandemic ("Felt nervous, anxious, or on edge," "Felt depressed," "Felt lonely," "Felt hopeless about the future," "Had physical reactions such as sweating, trouble breathing, nausea or a pounding heart when thinking about your experience with the coronavirus pandemic"). These items are adapted from GAD-7 (General Anxiety Disorder-7), CES-D (Center for Epidemiological Studies Depression Scale) and Impact to Event Scale. Original answers coded on a 4-point scale (1 = Not at all or less than 1 day, 2 = 1–2 days, 3 = 3–4 days, 4 = 5–7 days) were averaged. As an alternative measure, using principal component analysis we converted the original responses into a single latent factor (Bartlett's Test of Sphericity $p < .001$; KMO Test = 0.85; Cronbach's alpha = 0.82). Statistical results using the factor scores (available on request) are consistent with those shown below.

2.2. Main predictors

There are three explanatory variables of interest. The first is social/mobility restrictions based on responses (coded 1 if affirmative; 0 otherwise) to the following items: "In the past 7 days, have your personal plans been changed or affected by the following types of restrictions, or not? A. K-12 school closure B. Pre-K or childcare closure C.

[2] We took two multiple-imputation approaches to account for missingness in our independent variables: (1) multiple-imputation using chained equations in Stata 15 (15 datasets; combined according to Rubin's rules); (2) multiple-imputation using *Amelia II* (imputed-datasets combined/analyzed in Stata) which accounts for the time-series nature of our data (Honaker et al., 2011). Under both approaches our substantive conclusions remain unchanged. *See* Online-Appendix for full results from approach (1).

College or training closure D. Ban on gatherings of 250 people or more E. Ban on gatherings of 50 people or more F. Ban on gatherings of 10 people or more G. Closure of place of worship H. Reduced public transportation I. Other reduced public services J. Closure of bars K. Closure of restaurants L. Closure of gyms or fitness facilities M. Closure of other businesses N. Canceled sport events O. Closure of work P. Work from home requirements Q. Quarantine requirements or stay-at-home orders R. International travel restrictions or bans S. Domestic travel restrictions or bans." Original answers are summed to create a scale.

As outlined, we also mobilize two types of social capital measures: one set at the individual-level and one at the contextual-level. Using the COVID Impact Survey, we operationalize four variables for individual social capital: neighborhood trust ("*Generally speaking, would you say that you can trust all the people, most of the people, some of the people, or none of the people in your neighborhood?*"), neighbor interaction ("*In the past month, how often did you talk with any of your neighbors?*"), civic engagement/volunteering ("*In the past month, did you spend any time volunteering for any organization or association, or not?*"), and remote contact with family and friends ("*In the past month, how often did you communicate with friends and family by phone, text, email, app, or using the Internet?*"). Consistent with prior research (for reviews, see e.g., Kawachi and Subramanian, 2006; Moore and Carpiano, 2020) they tap, respectively, a cognitive aspect of social capital (trust in neighbors),"weak-tie" aspect of social capital (interaction with neighbors), structural aspect of social capital (volunteering for an organization or association), and "strong-tie" aspect of social capital (frequency of communicating with family/friends). In other words, these measures gauge the cognitive/structural and weak/strong dimensions of individual social capital (see Nyqvist et al., 2014).

At the county-level, social capital is measured using the U.S. government-sponsored Social Capital Index (*SCI*) consisting of 4 sub-indices and 10 variables (in parentheses below) based on data from various sources collected between 2006 and 2016, primarily from 2013 forward. The sub-indices include *family-unity* (% births to unmarried women; % women currently married; % children with single parent), *community-health* (non-religious non-profit organizations per 1000; religious congregation per 1000; informal social engagement subindex), and *institutional-health* (Presidential election voting rate 2012 & 2016; mail-back census response rate; confidence in institutions subindex), and "collective efficacy" (violent crimes per 10,000). Scores for the sub-indices were first standardized to put them on a common scale and then weights were created for each by running principal components analysis. Each county's social capital index score was computed by taking the weighted sum of the scores and then standardizing it (for more detail, see Joint Economic Committee, 2018). In addition to the combined index, we also use family-unity, community-health, and institutional-health as alternative measures (subindices) of contextual social capital.

2.3. Controls

Our models adjust for the following individual-level confounders: sex, age, race, education, household size, employment status, household income, survey mode, and a set of dummies for the survey wave. At the contextual-level, we additionally include: numbers of COVID-19 cases and deaths (as reported by the Johns Hopkins Coronavirus Resource Center), unemployment rate, percentage of residents living under the official poverty level, Gini coefficient, percent Black, percent Hispanic, percent aged 65 and over, population density, dummy indicators for the (9-category) Census region, and the place of residency (urban/suburban/rural). For details on the descriptive statistics, see Table 1.

2.4. Analytic strategy

COVID Impact Study (W1–W3) consists of tens of thousands of respondents clustered across hundreds of US counties over time. To

Table 1
Descriptive statistics.

	N	Mean	Standard Deviation	Min	Max
(Outcome variable)					
Psychological distress	20,969	6.38	2.95	0	16
(Main predictors)	20,969	7.02	4.38	0	19
N of reported restrictions					
Volunteering					
Yes	20,783	0.15		0	1
Talk to neighbors					
Not at all	20,761	0.12		0	1
Once a month/a few times a month	20,761	0.42		0	1
A few times a week/ basically every day	20,761	0.46		0	1
Communicate with friends/family					
Not at all	20,812	0.01		0	1
Once a month/a few times a month	20,812	0.07		0	1
A few times a week/ basically every day	20,812	0.93		0	1
Neighbor Trust					
None	20,908	0.07		0	1
Some	20,908	0.41		0	1
Most	20,908	0.44		0	1
All	20,908	0.08		0	1
(Individual-level controls)	*20,956*	0.57		0	1
Sex (Female = 1)					
Census region					
Mid-Atlantic	20,969	0.12		0	1
East North Central	20,969	0.16		0	1
West North Central	20,969	0.11		0	1
South Atlantic	20,969	0.17		0	1
East South Central	20,969	0.05		0	1
West South Central	20,969	0.1		0	1
Mountain	20,969	0.15		0	1
Pacific	20,969	0.15		0	1
Household Income					
Under $10,000	20,349	0.05		0	1
$10,000 to under $20,000	20,349	0.07		0	1
$20,000 to under $30,000	20,349	0.09		0	1
$30,000 to under $40,000	20,349	0.09		0	1
$40,000 to under $50,000	20,349	0.08		0	1
$50,000 to under $75,000	20,349	0.18		0	1
$75,000 to under $100,000	20,349	0.15		0	1
$100,000 to under $150,000	20,349	0.16		0	1
$150,000 or more	20,349	0.14		0	1
Age					
18-24	20,966	0.06		0	1
25-34	20,966	0.15		0	1
35-44	20,966	0.15		0	1
45-54	20,966	0.14		0	1
55-64	20,966	0.21		0	1
65-74	20,966	0.21		0	1
75+	20,966	0.09		0	1
Education					
No HS diploma	20,930	0.03		0	1
High school or equivalent	20,930	0.12		0	1
Some college, no degree	20,930	0.19		0	1
Associate degree	20,930	0.1		0	1
Bachelors degree	20,930	0.29		0	1
Masters degree	20,930	0.18		0	1
	20,930	0.08		0	1

(*continued on next page*)

Table 1 (*continued*)

	N	Mean	Standard Deviation	Min	Max
Professional or Doctorate degree					
Household Size					
One person, I live by myself	20,959	0.3		0	1
Two persons	20,959	0.37		0	1
Three persons	20,959	0.14		0	1
Four persons	20,959	0.1		0	1
Five persons	20,959	0.05		0	1
Six or more persons	20,959	0.04		0	1
Place of residency					
Rural	20,969	0.05		0	1
Suburban	20,969	0.14		0	1
Urban	20,969	0.81		0	1
Employment Status					
Yes, I worked for someone else	20,816	0.42		0	1
Yes, self-employed	20,816	0.08		0	1
Caring for someone	20,816	0.04		0	1
Do not want to be employed	20,816	0.04		0	1
Retired	20,816	0.28		0	1
Laid-off/Furloughed	20,816	0.08		0	1
Unemployed before/ after Covid-19	20,816	0.05		0	1
Survey Wave					
Wave 1	20,969	0.35		0	1
Wave 2	20,969	0.35		0	1
Wave 3	20,969	0.3		0	1
Survey Mode					
Phone	20,969	0.07		0	1
Web	20,969	0.93		0	1
(Contextual variables)					
Unemployment rate	20,969	4.58	1.12	0	10.5
Gini Coefficient	20,969	0.47	0.04	0.32	0.6
% Black	20,969	14.17	14.38	0	71.1
% Hispanic	20,969	14.43	15.05	0.1	99
% Aged Above 65	20,969	14.24	3.63	7.1	57.3
N of Cases	20,549	5759.72	16895.89	0.33	178041.6
N of Deaths	20,549	322.04	1488.05	0	19050.64
Aggregated Survey Social Capital Scores					
Mean Neighbor Talk	20,961	3.2	0.28	1	5
Mean Volunteering	20,963	0.15	0.08	0	1
Mean Friend/Family Communication	20,968	4.59	0.16	1	5
Mean Neighbor Trust	20,969	0.52	0.1	0	1
Independent Social Capital Indices					
Social Capital Index	20,895	−0.48	0.98	−3.73	2.54
Institutional Health	20,968	0.05	0.91	−2.63	2.73
Community Health	20,969	−0.55	0.7	−1.67	4.16
Family Unity	20,905	−0.11	0.86	−3.57	2.1

Notes: Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20–26, 2020), Wave 2 - May (4–10, 2020), Wave 3 - June (1–8, 2020); Data: COVID Impact Survey.

address data dependence, but more importantly to estimate contextual and cross-level interaction effects, we analyze the data using mixed-effects models (with individuals at level 1 and with counties at level 2).[3] In estimating cross-level interaction models, we allow the slope for restrictions to vary across the level-2 units (counties). Statistical modeling was conducted in both Stata and HLM with comparable results. Findings summarized and discussed below are from using the xtmixed command in Stata for linear multilevel models.[4] Formally, at the individual level (L1), we have the following equation:

$$Y_{ij} = \beta_{0j} + \sum_{q=1}^{Q} \beta_{qj} X_{qij} + r_{ij},$$

where $Y_{ij}$is the predicted value of Psychological distress, $\beta_{0j}$is the intercept;β_{qj} (q = 1, 2, …, Q) are the level 1 coefficients; and $X_{qij}$is the value of covariate q associated with respondent i in county j. The error termr_{ij} is the level 1 random effect, which is assumed to be independently and normally distributed with constant variance σ2. At the contextual level (level 2), which includes time fixed effects, our model takes the form:

$$\beta_{qj} = \gamma_{q0} + \gamma_{q1} W_{1j} + \gamma_{q2} W_{2j} \ldots + \gamma_{qS_q} W_{sj} + u_{qj} = \gamma_{q0} + \sum_{s=1}^{S_q} \gamma_{qs} W_{sj} + u_{qj},$$

where γ_{qs}(q = 1, 2, …S_q) are the L2 coefficients; W_{sj} is a L2 predictor; and u_{qj} is the L2 random effect. We report R-squared estimates for level-1 and level-2 based on the approach suggested by Snijders and Bosker (1999).

3. Results

We begin exploring individual-level social capital and its relationship with psychological-distress during the pandemic (Table 2). Model 1 tests H1, providing evidence that individuals reporting more restrictions exhibit higher distress ($p < .001$), with each increase in restrictions (0–19) increasing depression by 0.1 point (on a 0–20 scale). We next test whether individuals' social capital is associated with distress *during* the pandemic itself (H2). Model 2 includes each social capital measure. Individuals who have been speaking with neighbors more frequently and volunteering during the pandemic report significantly lower depression. Remote communication with friends/family and neighbor-trust, however, are not significantly associated with distress.

The third stage tests whether social capital cushions the impact of restrictions on psychological distress (H3). Model 3 includes interaction-terms between each dimension of individual-level social capital and number of restrictions. There is no significant difference in the association between restrictions and psychological distress between individuals who do/do not volunteer or who have more/less neighbor trust ($p > .1$). However, compared to those who do not speak to their neighbors at all, restrictions have a somewhat weaker impact among those talking to neighbors once/a few times a month ($p < .1$) but especially weaker among those talking to neighbors a few times a week/ everyday ($p < .01$).

To explore this moderating-role of neighbor-interaction, Fig. 1

[3] We modeled variation in psychological distress among individuals. To adjust for similarity over time, we added fixed effects for each survey wave and applied random effects by county to adjust for similarity among individuals located in the same geographic location. Our model is thus akin to cross-random effects by region and time.

[4] Tests for multicollinearity found no variance inflation factor (VIF) scores >10 before interaction-terms were introduced. Several interaction-terms exhibited VIFs >10. We replicated all models using mean-centered variables, which reduced the VIFs to <10 but critically produced substantively identical results to our main models, suggesting little bias from multicollinearity.

Table 2
Restrictions, Mental health, and Individual-level Social Capital.

	Model 1	Model 2	Model 3
Dependent variable:	Depression	Depression	Depression
Test	Restrictions	+ind. SC	+ind. SC * Restrictions
Key variables			
N of Restrictions	0.088***	0.095***	−0.114
	(0.009)	(0.009)	(0.137)
Talk to neighbors (cf. Not at all)			
Once/few times a month		−0.407*	0.096
		(0.163)	(0.179)
Few times a week/everyday		−0.722***	−0.079
		(0.146)	(0.239)
Past month volunteered (cf. No)			
Yes		−0.306*	−0.329
		(0.137)	(0.303)
Communicate with friends/ family (cf. Not at all)			
Once/few times a month		−0.267	−1.412
		(0.848)	(1.165)
Few times a week/everyday		−0.242	−1.698
		(0.974)	(1.267)
Neighbor trust (cf. None/Some)			
Most/all		0.012	−0.132*
		(0.064)	(0.062)
Neighbor talk once/few times month * Restrictions			−0.071+
			(0.039)
Neighbor talk few times week/ everyday * Restrictions			−0.090**
			(0.033)
Volunteered past month * Restrictions			0.004
			(0.037)
Friend/Family talk once/few month * Restrictions			0.186
			(0.131)
Friend/Family talk few times week/everyday * Restrictions			0.230*
			(0.113)
Trust Most/all * Restrictions			0.020
			(0.012)
Constant	8.181***	8.921***	10.177***
	−0.763	−0.858	−1.237
R-squared (level 1)	0.102	0.117	0.12
R-squared (level 2)	0.092	0.095	0.099
N	19198	19198	19198

Notes: Significance levels: + 0.1; * 0.05; ** 0.01; *** 0.001; SC = social capital; ind. = individual; agg. = aggregated; SCI = social capital indices; SCId = SCI subdomains; Snijders/Bosker R-squared; models contain all individual-level and county-level covariates (although not shown); Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20–26, 2020), Wave 2 - May (4–10, 2020), Wave 3 - June (1–8, 2020); Unweighted sex/age demographics: 57% female; Aged 18–24 - 6%, 25–34 - 15%, 35–44 - 15%, 45–54 - 14%, 55–64 - 21%, 65–74 - 21%, 75+ - 9%; 19198 respondents (nested within 800 counties); Data: COVID Impact Survey.

(based on Model 3, Table 2) plots predicted margins of mental-distress across number of restrictions experienced, subdivided by the frequency of neighbor-interaction, illustrating the buffering role neighbor-interaction plays. Where restrictions are few, there is little difference in mental distress between those with higher/lower social capital. However, where restrictions increase, mental-distress increases much more sharply among those who have little neighbor-interaction (an increase in mental-distress of 3-points between minimum/maximum restrictions). Among those with more frequent neighbor-interaction, particularly those interacting a few times a week/every day, psychological distress climbs more slowly with increasing restrictions (an increase of 1.3-points between minimum/maximum restrictions).

Restrictions also appear to have a stronger positive association with distress among individuals who report communicating with their friends/family 'a few times week/everyday', compared to those who say 'not at all' ($p < .05$). However, an examination of predicted margins of psychological distress across number of restrictions, subdivided by frequency of remote family/friends communication (based on Model 3, Table 2), demonstrates highly overlapping confidence intervals for the margins across each group (Appendix-Fig. 1). Thus, the differences in distress appear largely non-significant for each group, providing weak evidence for any potential augmenting-effect of higher-family/friend connectivity on the harm of restrictions. Together, the results show mixed support for H3: informal-structural social capital (neighbor-interactions) negatively moderates the impact of restrictions; however, neither formal-structural (volunteering), cognitive (neighbor-trust), nor strong-tie social capital buffer restrictions.

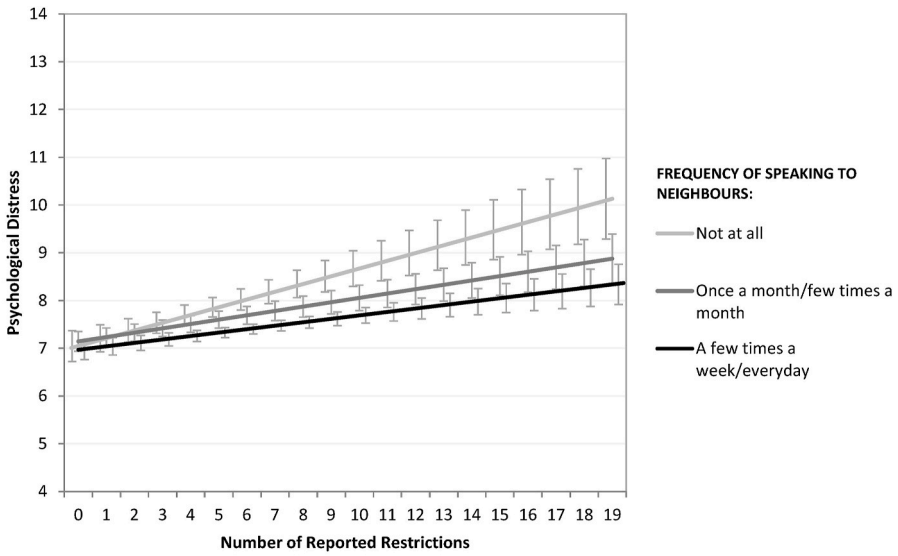
We next explore contextual social capital during the pandemic (Table 3); particularly, whether, after adjusting models for individual-level social capital, county social capital exerts independent-effects on psychological distress. We also seek to explore whether *how* contextual-level social capital is measured affects assessment of its role: using individuals' social capital scores aggregated to the county-level or independently collected SCIs.

We begin analysing county-level aggregated scores. Model 1 (Table 3) tests whether individuals in places with higher aggregate social capital report less distress (H4). After adjusting for individual-level social capital, no dimension of contextual social capital is associated with the outcome ($p > .1$). We next explore whether contextual-level social capital cushions (moderates) the impact of mobility restrictions on mental distress (H5). Model 2 includes an interaction-term between individuals' reported restrictions and the aggregated social capital score for each social capital dimension. Results show that restrictions only exhibit a significant, negative interaction with aggregate neighbor-interactions ($p < .05$), i.e., restrictions have weaker-effects where individuals live in counties with higher aggregate neighbor-interaction.

To explore this moderation, Fig. 2 (based on Model 2, Table 3) plots predicted margins of mental-distress across restrictions, subdivided by counties with the lowest (1) and highest (5) aggregate neighbor-interaction. While restrictions have a strong positive association with mental-distress in counties with low neighbor-interaction, it has no association in counties with high neighbor interaction. These results thus provide partial support for H5: higher contextual informal-structural social capital cushions the impact of restrictions on psychological distress. Importantly, this finding is present while adjusting for the interaction-term between restrictions and individual-level neighbor interaction (which remains significant). Therefore, higher stocks of both individual- and contextual-level neighbor-interaction cushion restrictions.

We next examine contextual social capital captured using the survey-independent SCI measures. Model 3 (Table 3) uses the single index of county social capital (compiled of family unity, community health, institutional health). Here, individuals in counties with higher stocks of social capital report somewhat less mental distress (significant at $p < .1$). Contrary to the aggregated scores, this shows some evidence for H4: that after adjusting for individual social capital, higher community social capital will reduce distress. Model 4 tests whether SCI-measured county social capital also cushions the impact of restrictions on mental-distress, via an interaction-term between the SCI and reported restrictions. The interaction is weakly significant ($p < .1$) but also positive, suggesting restrictions have a stronger positive association with psychological distress among individuals in high social capital counties.

Fig. 3 (based on Model 4, Table 3) plots predicted margins of distress across individuals' reported restrictions for those living at the maximum/minimum county-level SCI. Among individuals in *low* social capital counties, restrictions have no association with distress, which



Notes: Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20-26, 2020), Wave 2 - May (4-10, 2020), Wave 3 - June (1-8, 2020); Unweighted sex/age demographics: 57% female; Aged 18-24 - 6%, 25-34 - 15%, 35-44 - 15%, 45-54 - 14%, 55-64 - 21%, 65-74 - 21%, 75+ - 9%; 19198 respondents (nested within 800 counties); Data: COVID Impact Survey

Fig. 1. Restrictions and the buffering-effect of individual-level neighbor-interaction for mental distress (based on Model 3, Table 2).

remains comparatively high across all levels of restrictions. Individuals in high social capital counties who report fewer restrictions (0–8) experience a benefit of high county social capital, reporting lower distress than their peers in low social capital counties. However, the benefit of living in high social capital counties declines as restrictions increase, such that those experiencing moderate-to-high restrictions (>8) essentially report as much mental-distress as individuals in low social capital counties. This provides some evidence that contextual social capital can cushion the harm of restrictions on distress; however, the cushioning-effect gets weaker the greater number of restrictions experienced (H5).

To further examine the role of the independent measures of social capital, we utilize the three sub-domains of county social capital: family unity, community health and institutional health. Model 5 (Table 3) includes the three sub-domain measures (substituted for the overall index) to explore their direct association with distress (H4). However, none of the sub-domains exhibit a significant relationship with distress ($p > .1$). Lastly, Model 6 tests whether particular domains are more/less important for buffering the restrictions/distress relationship via interaction-terms between restrictions and each social capital sub-domain (H5). There is no significant interaction between restrictions and institutional-health nor family-utility but a positive, significant interaction between county-level community-health and restrictions ($p < .05$). Fig. 4 (based on Model 6, Table 3) shows the predicted margins of distress across restrictions, subdivided by the maximum/minimum county community-health. A similar relationship to that observed using the overall social capital index emerges. However, this time, individuals in high social capital counties reporting the highest restrictions report greater psychological-distress than their peers in low-community-health counties (although this difference is not significant).

Models 7 and 8 explore whether the relationships between aggregated social capital measures and independently measured social capital are co-related. Model 7 includes the aggregate social capital measures (and their interactions with individuals' number of restrictions) and the independently measured overall social capital index (and its interaction with restrictions). Model 8 repeats this but using the SCI sub-domains. However, the substantive conclusions remain unchanged (and coefficients vary little). Aggregated contextual social capital and independently measured contextual social capital appear to pick up different aspects of contextual social capital.

4. Discussion

Fields from epidemiology to sociology document the positive role social capital plays for mental health—not only as a driver of well-being but also as a source of resilience, mitigating stressors in people's lives. This paper investigated what role social capital plays for mental health during the pandemic; particularly, how far it protected people from the harms of social/mobility-restrictions. Concurrently, we sought to contribute to ongoing conceptual debates concerning the role of social capital: firstly, at what level the benefits of social capital are accrued and thus at what level it should be measured (individual-versus community level); and secondly, how best to capture contextual-level social capital using individual-level reports aggregated to the US county-level or, in a novel approach, applying independently constructed county-level Social Capital Indices.

Our findings have important implications for understanding the role of social capital for mental well-being during "extraordinary times", such as the current pandemic. Firstly, weaker ties, especially neighbor-connectivity, appeared most important for psychological-distress. Individuals who interacted more frequently with neighbors reported less distress and experienced a weaker positive impact of social/mobility restrictions on their distress. In addition, individuals living in counties with higher aggregate neighbor-connectivity reported a further cushioning effect from the harm of restrictions. Thus, as hypothesised, localities performed a vital role in compensating for the contraction of wider in-person connectivity, especially where restrictions were higher. In contrast, communicating more frequently by phone/electronically with friends/family had no association with psychological distress, nor did it buffer restrictions. This may be because this stronger-tie connectivity was not in-person, limiting its effectiveness. During *non*-crisis times, remote strong-tie connectivity may reduce mental-distress. However, in the context of COVID-19, the scarcity of in-person contact in general might mean that remote-interaction, even with strong-ties, does not

Table 3
Restrictions, Mental health and County-level Aggregate and Administrative Social Capital.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent variable:	Depression	Depression	Depression	Depression	Depression	Depression	Depression	Depression
Test:	+county: agg. SC	+county: agg. SC * Restrictions	+county: SCI	+county: SCI * Restrictions	+county: SCId	+county: SCId * Restrictions	+county: (agg. *and* SCI) * Restrictions	+county: (agg. *and* SCId) * Restrictions
Key variables								
Restrictions	−0.114	−0.281	−0.115	−0.100	−0.110	−0.083	−0.281	−0.158
	(0.135)	(0.365)	(0.138)	(0.136)	(0.136)	(0.132)	(0.354)	(0.321)
Talk neighbors (cf. Not at all)								
Once/few times a month	0.120	0.024	0.094	0.102	0.094	0.089	0.026	0.008
	(0.182)	(0.156)	(0.180)	(0.177)	(0.178)	(0.168)	(0.148)	(0.150)
Few times a week/ everyday	−0.028	−0.163	−0.083	−0.081	−0.081	−0.078	−0.173	−0.178
	(0.253)	(0.285)	(0.232)	(0.227)	(0.243)	(0.237)	(0.273)	(0.286)
Talk neighbors (once/few month) * Restrictions	−0.071+	−0.058	−0.071+	−0.073+	−0.071+	−0.072+	−0.059+	−0.058+
	(0.038)	(0.036)	(0.039)	(0.038)	(0.039)	(0.037)	(0.035)	(0.035)
Talk neighbors (few times week/everyday) * Restrictions	−0.091**	−0.074*	−0.090**	−0.091**	−0.090**	−0.092**	−0.074*	−0.074*
	(0.033)	(0.037)	(0.032)	(0.032)	(0.033)	(0.032)	(0.036)	(0.037)
Volunteering (cf. No)								
Yes	−0.345	−0.279	−0.321	−0.315	−0.339	−0.324	−0.261	−0.292
	(0.317)	(0.310)	(0.301)	(0.297)	(0.296)	(0.287)	(0.303)	(0.296)
Volunteering * Restrictions	0.005	−0.003	0.003	0.002	0.005	0.004	−0.004	0.000
	(0.037)	(0.037)	(0.036)	(0.036)	(0.036)	(0.035)	(0.036)	(0.035)
Communicate family/ friends (cf. Not at all)								
Once/few times a month	−1.391	−1.151	−1.427	−1.462	−1.375	−1.355	−1.194	−1.123
	(1.130)	(1.207)	(1.173)	(1.180)	(1.179)	(1.185)	(1.210)	(1.226)
Few times a week/ everyday	−1.666	−1.304	−1.702	−1.722	−1.660	−1.654	−1.316	−1.294
	(1.224)	(1.425)	(1.270)	(1.276)	(1.277)	(1.278)	(1.421)	(1.433)
Communicate (once/few month) * Restrictions	0.187	0.150	0.188	0.191	0.183	0.176	0.153	0.144
	(0.129)	(0.110)	(0.133)	(0.132)	(0.131)	(0.128)	(0.110)	(0.110)
Communicate (few times week/everyday) * Restrictions	0.230*	0.172+	0.232*	0.233*	0.226*	0.221*	0.174+	0.169+
	(0.110)	(0.102)	(0.114)	(0.113)	(0.111)	(0.107)	(0.103)	(0.101)
Neighbor trust (cf. None/ Some)								
Most/all	−0.150*	−0.143+	−0.131*	−0.129*	−0.134*	−0.133*	−0.136+	−0.144+
	(0.064)	(0.085)	(0.060)	(0.061)	(0.063)	(0.063)	(0.082)	(0.084)
Trust Most/all * Restrictions	0.020	0.020	0.020	0.020	0.020	0.020	0.019	0.020
	(0.012)	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)
County-level Aggregated Social Capital measures								
Aggregate Neighbor talk	−0.194	0.319					0.337	0.391+
	(0.135)	(0.221)					(0.230)	(0.217)
Aggregated Volunteering	0.147	−0.757					−0.760	−0.447
	(0.340)	(0.970)					(0.862)	(0.857)
Aggregated Friends/ Family talk	−0.030	−0.670					−0.695+	−0.658
	(0.292)	(0.420)					(0.413)	(0.425)
Aggregated Neighbor trust	0.414	0.876					0.813	0.929
	(0.303)	(0.726)					(0.754)	(0.790)
Aggregated Neighbor talk * Restrictions		−0.076*					−0.079*	−0.087*
		(0.038)					(0.037)	(0.036)
Aggregated Volunteering * Restrictions		0.134					0.124	0.082
		(0.160)					(0.143)	(0.151)
Aggregated Friends/ Family talk * Restrictions		0.101					0.106	0.093
		(0.098)					(0.096)	(0.091)
Aggregated Neighbor trust * Restrictions		−0.062					−0.054	−0.084
		(0.119)					(0.118)	(0.117)

(*continued on next page*)

Table 3 (*continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent variable:	Depression	Depression	Depression	Depression	Depression	Depression	Depression	Depression
Test:	+county: agg. SC	+county: agg. SC * Restrictions	+county: SCI	+county: SCI * Restrictions	+county: SCId	+county: SCId * Restrictions	+county: (agg. *and* SCI) * Restrictions	+county: (agg. *and* SCId) * Restrictions
County Administrative Social Capital								
Social Capital Index			−0.213+	−0.417**			−0.445***	
			(0.119)	(0.153)			(0.133)	
Social Capital Index * Restrictions				0.028+			0.030+	
				(0.016)			(0.015)	
Variegated County Administrative Social Capital								
Institutional health					0.241	−0.058		−0.090
					(0.214)	(0.139)		(0.141)
Community health					−0.088	−0.353**		−0.392**
					(0.115)	(0.115)		(0.147)
Family Unity					−0.113	−0.235		−0.232
					(0.080)	(0.229)		(0.208)
Institutional health * Restrictions						0.039		0.040
						(0.034)		(0.030)
Community health * Restrictions						0.038*		0.047*
						(0.017)		(0.020)
Family Unity * Restrictions						0.005		0.006
						(0.023)		(0.020)
Constant	10.685***	11.687***	10.592***	10.503***	10.587***	10.409***	12.122***	11.554***
	(1.681)	(1.642)	(1.283)	(1.269)	(1.257)	(1.207)	(1.485)	(1.371)
R-squared (level 1)	0.121	0.122	0.12	0.121	0.122	0.122	0.123	0.126
R-squared (level 2)	0.112	0.112	0.11	0.11	0.113	0.113	0.115	0.12
N	19198	19198	19198	19198	19198	19198	19198	19198

Notes: Significance levels: + 0.1; * 0.05; ** 0.01; *** 0.001; SC = social capital; ind. = individual; agg. = aggregated; SCI = social capital indices; SCId = SCI subdomains Snijders/Bosker R-squared; models contain all individual-level and county-level covariates (not shown); Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20–26, 2020), Wave 2 - May (4–10, 2020), Wave 3 - June (1–8, 2020); Unweighted sex/age demographics: 57% female; Aged 18–24 - 6%, 25–34 - 15%, 35–44 - 15%, 45–54 - 14%, 55–64 - 21%, 65–74 - 21%, 75+ - 9%; 19198 respondents (nested within 800 counties); Data: COVID Impact Survey.

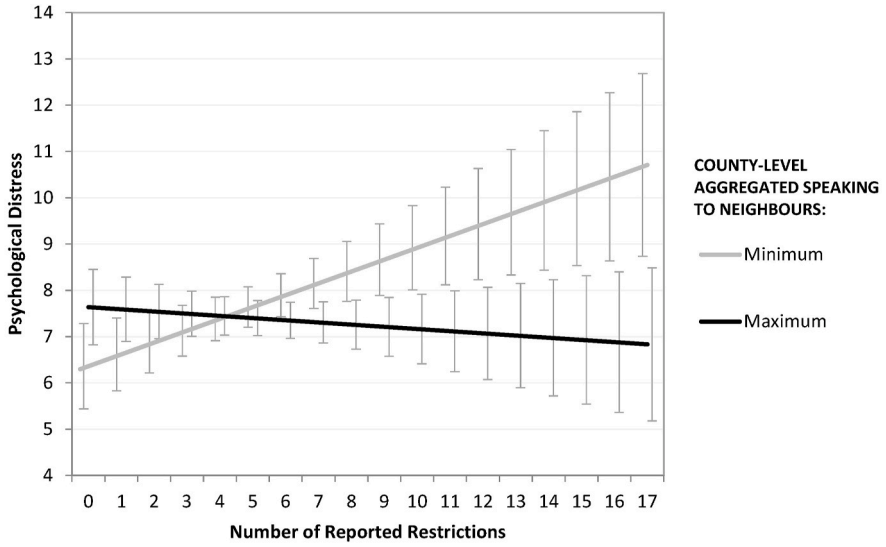
suffice, and any type of *physical* interaction becomes increasingly important. Alternatively, individuals experiencing greater distress could have reached out more to friends/family, confounding any ameliorating impact it may have had on distress.

Secondly, these findings shed light on how, and at which level, social capital appears to operate during the pandemic. At the individual-level, (weaker-tie) social capital appears to operate as both a driver of lower distress (a direct-effect) and a buffer of the impact of stressors, namely restrictions (a moderation effect). Processes at the contextual level, however, appear more mixed and our understanding is conditional on how contextual-level social capital is measured. When operationalized using aggregated scores, contextual social capital has no direct effect on distress after adjusting for individual-level social capital. However, (weaker-tie) aggregated social capital does buffer the impact of restrictions on distress, even after adjusting for its individual-level buffering role. In other words, both speaking to neighbors more frequently but also living in counties where neighbors interact more frequently benefits mental well-being.

When contextual-level social capital is operationalized using independent SCI measures, however, our interpretation shifts. There is some evidence that living in a county with a higher SCI does exert a negative direct effect on mental distress. However, this effect is highly conditional on one's number of restrictions. Specifically, while contextual social capital may reduce distress (alongside individual-level social capital), greater restrictions appear to sever the negative link between contextual social capital and distress. Thus, its ability to buffer against the harm of restrictions becomes weaker under more restrictive environments.

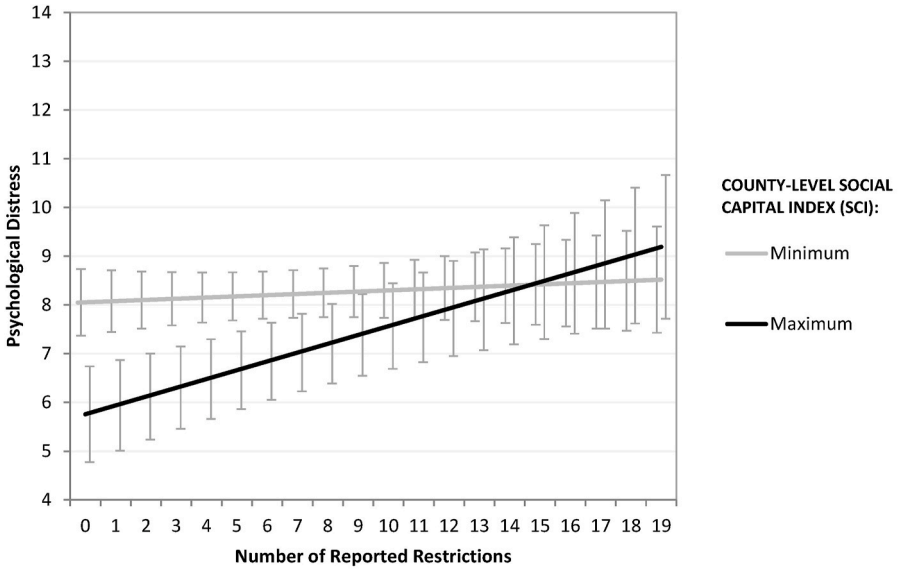
Why do we observe these differences in operation between aggregated and independently measured contextual social capital? One possibility concerns the time periods at which measurements were taken. The SCI is based on surveys/administrative data completed mostly 2013–2016, while the aggregated scores are contemporaneous with the psychological distress scores. Potentially, the pandemic may have undermined contextual-level social capital, and thus our independent measures no longer capture up-to-date social capital. As such, it may be that where individuals report lower restrictions, the SCI indicator remains accurate (having been less affected by the pandemic). Thus, in counties where SCI-measured contextual social capital is higher and individuals' experiences of restrictions lower, residents continue to accrue mental health benefits. However, where individuals report higher restrictions, contextual social capital may have been undermined, and thus, despite living in counties with high *pre*-pandemic social capital, its negative effect on distress is no longer present given levels may since have been eroded. In contrast, the aggregate scores measured during the pandemic may more accurately reflect current county social capital, demonstrating that where contextual social capital has persisted it serves to cushion the harm of restrictions.

Alternatively, our aggregated measures may be biased by endogeneity. For example, individuals reporting less distress may simply be



Notes: Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20-26, 2020), Wave 2 - May (4-10, 2020), Wave 3 - June (1-8, 2020); Unweighted sex/age demographics: 57% female; Aged 18-24 - 6%, 25-34 - 15%, 35-44 - 15%, 45-54 - 14%, 55-64 - 21%, 65-74 - 21%, 75+ - 9%; 19198 respondents (nested within 800 counties); Data: COVID Impact Survey

Fig. 2. Restrictions and the buffering-effect of county-level aggregated neighbor-interaction for mental distress (based on Model 2, Table 3).

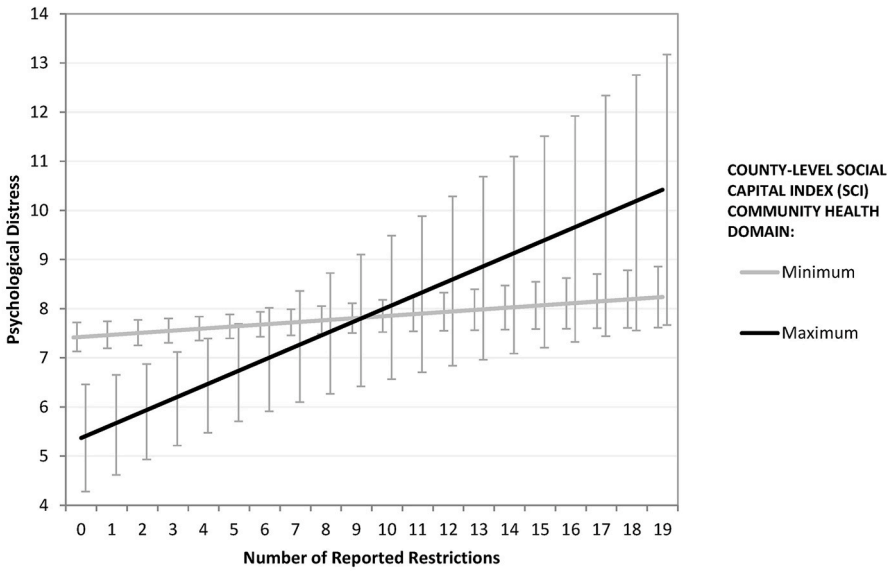


Notes: Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20-26, 2020), Wave 2 - May (4-10, 2020), Wave 3 - June (1-8, 2020); Unweighted sex/age demographics: 57% female; Aged 18-24 - 6%, 25-34 - 15%, 35-44 - 15%, 45-54 - 14%, 55-64 - 21%, 65-74 - 21%, 75+ - 9%; 19198 respondents (nested within 800 counties); Data: COVID Impact Survey

Fig. 3. Restrictions and the buffering-effect of independent county-level Social Capital Index (SCI) for mental distress (based on Model 4, Table 3).

more inclined to respond that they speak to their neighbors more frequently, regardless of actual behaviors. At the aggregate level, therefore, higher county-level neighbor interaction may simply be driven by lower aggregate distress. Thus, the reason mobility restrictions appear to exert a weaker effect on individuals' mental distress where aggregate neighbor interaction is higher may simply be that individuals in such counties tend to have lower psychological distress (for some unmeasured reason). If so, our findings using aggregated measures are unreliable. Accordingly, our results using the independent county measures would suggest that contextual social capital can operate to reduce distress, but that the pandemic may have cut people off from accessing the social capital benefits in their counties.

A third possibility is that the aggregated-/independent-measures are picking up qualitatively different forms of social capital. In particular,



Notes: Geographic coverage: United States of America - 10 states (California, Colorado, Florida, Louisiana, Minnesota, Missouri, Montana, New York, Oregon, Texas) and 8 Metropolitan Statistical Areas (Atlanta, Baltimore, Birmingham, Chicago, Cleveland, Columbus, Phoenix, Pittsburgh); Time-frame: Wave 1 - April (20-26, 2020), Wave 2 - May (4-10, 2020), Wave 3 - June (1-8, 2020); Unweighted sex/age demographics: 57% female; Aged 18-24 - 6%, 25-34 - 15%, 35-44 - 15%, 45-54 - 14%, 55-64 - 21%, 65-74 - 21%, 75+ - 9%; 19198 respondents (nested within 800 counties); Data: COVID Impact Survey

Fig. 4. Restrictions and the buffering-effect of independent county-level Community Health Index for mental distress (based on Model 6, Table 3).

the SCI, especially the Community Health domain, may better tap civic infrastructures within counties. While a stronger civic infrastructure appears able to reduce distress, accessing the benefits of such organizations/involvement likely depends on individuals' ability to participate and meet through groups. Accordingly, where restrictions are higher, and ability to participate is curtailed, individuals may be increasingly cut-off from accessing such benefits; thus, the SCI exerts an increasingly weaker effect on distress as restrictions increase. In contrast, accessing neighborhood-ties likely remains possible even under restrictive-environments, and thus its positive benefits become increasingly important as restrictions increase. Such an interpretation has important implications regarding the relative-benefits different forms of social capital afford under different types of crisis.

These findings thus speak directly to debates on how to operationalize contextual-level social capital. Our interpretation of the role of contextual social capital significantly depends on how it is measured. Since the "research into the influence of both individual- and neighborhood-level social capital on health is scarce" (Mohnen et al., 2015, p.198), we sought to contribute to the literature by incorporating them simultaneously for a theoretically more meaningful and statistically more stringent analysis. As noted, individual and collective forms of social capital are not mutually exclusive (Kawachi, 2006). As such, gauging social capital at *both* levels provides a fuller picture of why some people fare better in terms of health and wellbeing (Villalonga-Olives and Kawachi, 2015).

Notwithstanding the insights gleaned, this study has limitations. With cross-sectional data, there remain feasible reverse causality accounts. For example, given restrictions are self-reported, it may be that individuals with higher distress, or those more anxious about the pandemic in general, personally felt their lives were more restricted; thus, distress may have caused individuals to report more restrictions. Similarly, as alluded to above, any association between social capital and well-being could feasibly be a product of lower distress causing more social capital, generating additional bias. To our knowledge, no longitudinal data currently exists that would allow us to test these individual/contextual social capital processes over time. Lastly, the number of tests performed increases risks of false positives in our findings. Applying the Benjamini and Hochberg (1995) correction, our key findings remain robust at a false discovery rate (FDR) of $\geq$10 percent; at an FDR of <5 percent, the moderating-effects of our contextual social capital measures would be considered just outside of significance, while individual-levels findings remain significant. Future research replicating the paper's findings will be critical to further validate the results.

In sum, this paper provides some of the first evidence that individuals' social capital, especially neighbor connectivity, may serve a critical support role during the pandemic, cushioning the harm that pandemic-related restrictions have on mental health. In addition, we find conflicting evidence for how contextual-level social capital has operated during the pandemic. It may have operated as an additional buffer against the pain of restrictions (when measured using aggregate individual scores). Alternatively, the pandemic may have severed the support link between contextual social capital and mental health (when measured using independent measures). These findings make key contributions to our ongoing understanding of how social capital should be conceptualized as well as raising important awareness for ongoing debates into how contextual social capital should be measured and operationalized.

Both authors contributed equally to this research in terms of conception, analysis, and writing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2021.114361.

Funding

This work was generously supported with funding from the Economic and Social Research Council [grant number ES/S013121/1]

References

Aldrich, D.P., Meyer, M.A., 2014. Social capital and community resilience. Am. Behav. Sci. 59 (2), 254–269. https://doi.org/10.1177/0002764214550299.

Bastiampillai, T., Allison, S., Looi, J.C.L., Licinio, J., Wong, M., Perry, S.W., 2020. The Covid-19 pandemic and epidemiologic insights from recession-related suicide mortality. Mol. Psychiatr. 25, 3445–3447. https://doi.org/10.1038/s41380-020-00875-4.

Benjamini, Y., Hochberg, Y., 1995. Controlling the false discovery rate: a practical and powerful approach to multiple testing. J. Roy. Stat. Soc. B 57 (1), 289–300.

Bonanno, G.A., 2004. Loss, trauma, and human resilience: have we underestimated the human capacity to thrive after extremely aversive events? Am. Psychol. 59 (1), 20–28. https://doi.org/10.1037/0003-066X.59.1.20.

Borkowska, M., Laurence, J., 2020. Coming together or coming apart? Changes in social cohesion during the Covid-19 pandemic in England. Eur. Soc. 23 (1), 618–S636. https://doi.org/10.1080/14616696.2020.1833067.

Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., Rubin, G.J., 2020. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 395 (102227), 14–20. https://doi.org/10.1016/S0140-6736(20)30460-8.

Butel, J., Braun, K.L., 2019. The role of collective efficacy in reducing health disparities: a systematic review. Fam. Community Health 42 (1), 8–19. https://doi.org/10.1097/FCH.0000000000000206.

Carpiano, R.M., Hystad, P.W., 2011. "Sense of community belonging" in health surveys: what social capital is it measuring? Health Place 17, 606–617. https://doi.org/10.1016/j.healthplace.2010.12.018.

Daly, M., Sutin, A.R., Robinson, E., 2021. Depression reported by US adults in 2017-2018 and march and April in 2020. J. Affect. Disord. 278, 131–135. https://doi.org/10.1016/j.jad.2020.09.065.

De Clercq, B., Vyncke, V., Hublet, A., Elgar, F.J., Ravens-Sieberer, U., Currie, C., Hooghe, M., Ieven, A., Maes, L., 2012. Social capital and social inequality in adolescents' health in 601 Flemish communities: a multilevel analysis. Soc. Sci. Med. 74, 202–210. https://doi.org/10.1016/j.socscimed.2011.10.025.

De Silva, M.J., McKenzie, K., Harpham, T., Huttly, S.R.A., 2005. Social capital and mental illness: a systematic review. J. Epidemiol. Community Health 59, 619–627. https://doi.org/10.1136/jech.2004.029678.

Ehsan, A.M., Klaas, H.S., Bastianen, A., Spini, D., 2019. Social capital and health: a systematic review of systematic reviews. SSM Popul. Health 8, 100425. https://doi.org/10.1016/j.ssmph.2019.100425.

Ehsan, A.M., De Silva, M.J., 2015. Social capital and common mental disorder: a systematic review. J. Epidemiol. Community Health 69 (10), 1021–1028. https://doi.org/10.1136/jech-2015-205868.

Elliott, J., Gale, C.R., Parsons, S., Kuh, D., The HALCyon Study Team, 2014. Neighborhood cohesion and mental wellbeing among older adults: a mixed methods approach. Soc. Sci. Med. 107, 44–51. https://doi.org/10.1016/j.socscimed.2014.02.027.

Ertel, K.A., Glymour, M.M., Berkman, L.F., 2009. Social networks and health: a life course perspective integrating observational and experimental evidence. J. Soc. Pers. Relat. 26 (1), 73–92. https://doi.org/10.1177/0265407509105523.

Fahmi, M., Panjaitan, N.A., Habibie, I., Siregar, A.Y.M., Amarullah, G., Sunjaya, R., Sunjaya, D.K., 2019. Does your neighborhood protect you from being depressed? A study on social trust and depression in Indonesia. BMC Publ. Health 19, 1371. https://doi.org/10.1186/s12889-019-7657-5.

Ferlander, S., 2007. The importance of different forms of social capital for health. Acta Sociol. 50 (2), 115–128. https://doi.org/10.1177/0001699307077654.

Gilbert, K.L., Quinn, S.C., Goodman, R.M., Butler, J., Wallace, J., 2013. A meta-analysis of social capital and health: a case for needed research. J. Health Psychol. 18 (11), 1385–1399. https://doi.org/10.1177/1359105311435983.

Green, G., Fone, D., Farewell, D., Rodgers, S., Paranjothy, S., Carter, B., White, J., 2019. Improving mental health through neighborhood regeneration: the role of cohesion, belonging, quality and disorder. Eur. J. Publ. Health 30 (5), 964–966. https://doi.org/10.1093/eurpub/ckz221.

Hardyns, W., Vyncke, V., Pauwels, L., Willems, S., 2015. Study protocol: SWING – social capital and well-being in neighborhoods in Ghent. Int. J. Equity Health 14 (1), 36. https://doi.org/10.1186/s12939-015-0163-1.

Hikichi, H., Aida, J., Matsuyama, Y., Tsuboya, T., Kondo, K., Kawachi, I., 2020. Community-level social capital and cognitive decline after a natural disaster: a natural experiment from the 2011 Great East Japan Earthquake and Tsunami. Soc. Sci. Med. 257, 111981. https://doi.org/10.1016/j.socscimed.2018.09.057.

Honaker, J., King, G., Blackwell, M., 2011. Amelia II: a program for missing data. J. Stat. Software 1 (7), 1–47.

Hoogerbrugge, M.M., Burger, M.J., 2018. Neighborhood-based social capital and life satisfaction: the case of Rotterdam, The Netherlands. Urban Geogr. 39 (10), 1484–1509. https://doi.org/10.1080/02723638.2018.1474609.

Hooper, M.W., Nápoles, A.M., Pérez-Stable, E.J., 2020. COVID-19 and racial/ethnic disparities. J. Am. Med. Assoc. 323 (24), 2466–2467. https://doi.org/10.1001/jama.2020.8598.

Joint Economic Committee, 2018. The Geography of Social Capital in America Project. https://www.jec.senate.gov/public/index.cfm/republicans/2018/4/the-geography-of-social-capital-in-america.

Kawachi, I., 2006. Commentary: social capital and health: making the connections one step at a time. Int. J. Epidemiol. 35 (4), 989–993. https://doi.org/10.1093/ije/dyl117.

Kawachi, I., Subramanian, S.V., 2006. Measuring and modeling the social and geographic context of trauma: a multilevel modeling approach. J. Trauma Stress 19 (2), 195–203. https://doi.org/10.1002/jts.20108.

Kawachi, I., Subramanian, S.V., Kim, D. (Eds.), 2008. Social Capital and Health. Springer, New York. https://doi.org/10.1007/978-0-387-71311-3_14.

Kim, H.H., Laurence, J., 2020. COVID-19 restrictions and mental distress among American adults: evidence from Corona Impact Survey (W1 and W2). J. Public Health 42 (4), 704–711. https://doi.org/10.1093/pubmed/fdaa148.

Lagaert, S., Snaphaan, T., Vyncke, V., Hardyns, W., Pauwels, L.J.R., Willems, S., 2021. A multilevel perspective on the health effect of social capital: evidence for the relative importance of individual social capital over neighborhood social capital. Int. J. Environ. Res. Publ. Health 18, 1526. https://doi.org/10.3390/ijerph18041526.

Ledogar, R.J., Fleming, J., 2008. Social capital and resilience: a review of concepts and selected literature releant to aboriginal youth resilience research. Pimatisiwin 6 (2), 25–46.

Maass, R., Kloeckner, C.A., Lindstrøm, B., Lillefjell, M., 2016. The impact of neighborhood social capital on life satisfaction and self-rated health: a possible pathway for health promotion? Health Place 42, 120–128. https://doi.org/10.1016/j.healthplace.2016.09.011.

Mein, S.A., 2020. COVID-19 and health disparities: the reality of "the Great Equalizer". J. Gen. Intern. Med. 35 (8), 2439–2440. https://doi.org/10.1007/s11606-020-05880-5.

Melo, M.C.A., Soares, D., 2020. Impact of social distancing on mental health during the COVID-19 pandemic: an urgent discussion. Int. J. Soc. Psychiatr. 66 (6), 625–626. https://doi.org/10.1177/0020764020927047.

Mohnen, S.M., Völker, B., Flap, H., Subramanian, S.V., Groenewegen, P.P., 2015. The influence of social capital on individual health: is it the neighborhood or the network? Soc. Indicat. Res. 121 (1), 195–214. https://doi.org/10.1007/sl1205-014-0632-8.

Moore, S., Carpiano, R.M., 2020. Introduction to the special issue on "social capital and health: what have we learned in the last 20 years and where do we go from here?". Soc. Sci. Med. (257), 113014. https://doi.org/10.1016/j.socscimed.2020.113014.

Moore, S., Shiell, A., Hawe, P., Haines, V.A., 2005. The privileging of communitarian ideas: citation practices and the translation of social capital into public health research. Am. J. Publ. Health 95 (8), 1330–1337. https://doi.org/10.2105/AJPH.2004.046094.

Nakagomi, A., Shiba, K., Hanazato, M., Kondo, K., Kawachi, I., 2020. Does community-level social capital mitigate the impact of widowhood & living alone on depressive symptoms?: a prospective, multi-level study. Soc. Sci. Med. 59 https://doi.org/10.1016/j.socscimed.2020.113140.

Nieuwenhuis, J., 2020. Neighborhood social capital and adolescents' individual health development. Soc. Sci. Med. 265, 113417. https://doi.org/10.1016/j.socscimed.2020.113417.

Nyqvist, F., Pape, B., Pellfolk, T., et al., 2014. Structural and cognitive aspects of social capital and all-cause mortality: a meta-analysis of cohort studies. Soc. Indicat. Res. 116, 545–566. https://doi.org/10.1007/s11205-013-0288-9.

Pietrabissa, G., Simpson, S.G., 2020. Psychological consequences of social isolation during COVID-19 outbreak. Front. Psychol. 11, 2201. https://doi.org/10.3389/fpsyg.2020.02201.

Perkins, J.M., Subramanian, S.V., Christakis, N.A., 2015. Social networks and health: a systematic review of sociocentric network studies in low-and middle-income countries. Soc. Sci. Med. 125, 60–78. https://doi.org/10.1016/j.socscimed.2014.08.019.

Pitas, N., Ehmers, C., 2020. Social capital in the response to COVID-19. Am. J. Health Promot. 34 (8), 942–944. https://doi.org/10.1177/0890117120924531.

Poortinga, W., 2006. Social relations or social capital? Individual and community-health effects of bonding social capital. Soc. Sci. Med. 63 (1), 255–270. https://doi.org/10.1016/j.socscimed.2005.11.039.

Portes, A., 2000. The two meanings of social capital. Socio. Forum 15 (1), 1–12. https://doi.org/10.1023/A:1007537902813.

Putnam, R., 2000. Bowling Alone: the Collapse and Revival of American Community. Simon & Schuster, New York. https://doi.org/10.1353/jod.1995.0002.

Raisi-Estabragh, Z., McCracken, C., Bethell, M.S., Cooper, J., Cooper, C., Caulfield, M.J., Munroe, P.B., Harvey, N.C., Petersen, S.E., 2020. Greater risk of severe COVID-19 in Black, Asian and minority ethnic populations is not explained by cardiometabolic, socioeconomic or behavioural factors, or by 25(OH)-vitamin D status: study of 1326 cases from the UK Biobank. J. Public Health 42 (3), 451–460. https://doi.org/10.1093/pubmed/fdaa095.

Rogers, J.P., Chesney, E., Oliver, D., Pollak, T.A., McGuire, P., Fusar-Poli, P., Zandi, M.S., Lewis, G., David, A.S., 2020. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. Lancet Psychiatry 7 (7), 611–627. https://doi.org/10.1016/S2215-0366(20)30203-0.

Sampson, R.J., 2003. The neighborhood context of well-being. Perspect. Biol. Med. 46 (3), S53–S64. https://doi.org/10.1353/pbm.2003.0059.

Saegert, S., Carpiano, R.M., 2017. Social support and social capital: a theoretical synthesis using community psychology and community sociology approaches. In: Bond, M.A., Serrano-García, I., Keys, C.B., Shinn, M. (Eds.), APA Handbooks in Psychology®. APA Handbook of Community Psychology: Theoretical Foundations, Core Concepts, and Emerging Challenges. American Psychological Association, pp. 295–314. https://doi.org/10.1037/14953-014.

Shiel, A., Hawe, P., Kavanagh, S., 2020. Evidence suggests a need to rethink social capital and social capital interventions. Soc. Sci. Med. 257, 111930. https://doi.org/10.1016/j.socscimed.2018.09.006.

Smith, K.P., Christakis, N.A., 2008. Social networks and health. Annu. Rev. Sociol. 34, 405–429. https://doi.org/10.1146/annurev.soc.34.040507.134601.

Snijders, Tom A.B., Bosker, Roel J., 1999. Multilevel Analysis. An Introduction to Basic and Advanced Multilevel Modeling. Sage, London.

Story, W.T., Tura, H., Rubin, J., Engidawork, B., Ahmed, A., Jundi, F., Iddosa, T., Abrha, T.H., 2020. Social capital and disaster preparedness in Oromia, Ethiopia: an evaluation of the "Women Empowered" approach. Soc. Sci. Med. 257, 111907. https://doi.org/10.1016/j.socscimed.2018.08.027.

Szreter, S., Woolck, M., 2004. Health by association? Social capital, social theory, and the political economy of public health. Int. J. Epidemiol. 33, 650–667.

Tsuchiya, N., Nakaya, N., Nakamura, T., Narita, A., Kogure, M., Aida, J., Tsuji, I., Hozawa, A., Tomita, H., 2017. Impact of social capital on psychological distress and interaction with house destruction and displacement after the Great East Japan Earthquake of 2011. Psychiatr. Clin. Neurosci. 71, 52–60. https://doi.org/10.1111/pcn.12467.

Villalonga-Olives, E., Kawachi, I., 2015. The measurement of social capital. Gac. Sanit. 29 (1), 62–64. https://doi.org/10.1016/j.gaceta.2014.09.006.

Villalonga-Olives, E., Wind, T.R., Kawachi, I., 2018. Social capital interventions in public health: a systematic review. Soc. Sci. Med. 212, 203–218. https://doi.org/10.1016/j.socscimed.2018.07.022.

Wright, A.L., Sonin, K., Driscoll, J., Wilson, J., 2020. Poverty and economic dislocation reduce compliance with COVID-19 shelter-in-place protocols. J. Econ. Behav. Organ. 180, 544–554. https://doi.org/10.1016/j.jebo.2020.10.008.

Wu, C., Chen, X., Cai, Y., 2020. Risk factors associated with acute respiratory distress syndrome and death in patients with Coronavirus disease 2019 Pneumonia in Wuhan, China. JAMA Intern Med 180 (7), 934–943. https://doi.org/10.1001/jamainternmed.2020.0994.

Yamaguchi, M., Inoue, Y., Shinozaki, T., Saito, M., Takagi, D., Kondo, K., Kondo, N., 2019. Community social capital and depressive symptoms among older people in Japan: a multilevel longitudinal study. J. Epidemiol. 29 (10), 363–369. https://doi.org/10.2188/jea.JE20180078.

Yaya, S., Yeboah, H., Charles, C.H., 2020. Ethnic and racial disparities in COVID-19 related deaths: counting the trees, hiding the forest. BMJ Global Health 5, e002913. https://doi.org/10.1136/bmjgh-2020-002913.

Ye, M., Aldrich, D.P., 2019. Substitute or complement? How social capital, age and socioeconomic status interacted to impact mortality in Japan's 3/11 tsunami. SSM Popul. Health 7, 100403. https://doi.org/10.1016/j.ssmph.2019.100403.

Zhanow, R., Wickes, R., Taylor, M., Corcoran, J., 2019. Community social capital and individual functioning in the post-disaster context. Disasters 43 (2), 261–288. https://doi.org/10.1111/disa.12317.