

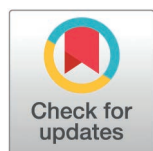
RESEARCH ARTICLE

# The association between community solidarity and adoption of public health preventive measures during the COVID-19 pandemic in a cross-sectional, multi-national sample

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## Abstract

### Background

Few studies have examined the association between community solidarity and health-related behaviors. This study investigates solidarity in navigating challenges during the COVID-19 pandemic.

### Methods

We used cross-sectional data from a multi-national survey of 1,346 respondents to examine (1) factors relating to feelings of solidarity, and (2) associations between solidarity and public health preventive behaviors.

### Results

More than half (53.1%) of participants expressed feelings of solidarity; they were more likely to be aged 30 years or over, employed full-time, and residing in Eastern economies. We found a statistically significant association between positive feelings of solidarity and three of five COVID-19 prevention behaviors (social distancing,

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**Data availability statement:** The data in this study are part of a larger dataset that is securely stored at the institution that led the multi-national survey (the Chinese University of Hong Kong). The informed consent process did not inform participants that their de-identified data would be made publicly available. Therefore, for ethical reasons we are unable to publicly share the dataset and data will be made available upon request to the authors. This study received primary ethics approval from the WHO Research Ethics Review Committee and Survey and Behavioural Research Ethics Committee (SBREC) of the Chinese University of Hong Kong. The SBREC may be contacted at: [fssc02@cuhk.edu.hk](mailto:fssc02@cuhk.edu.hk)

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skipping an event, and masking in public). Those who reported previous influenza vaccination were also more likely to adopt these behaviors.

## Discussion

The findings underscore the potential of fostering community solidarity to enhance prosocial actions amid widespread emergencies.

## Background

The COVID-19 pandemic has had unprecedented health, social, and economic impact and has, in many settings, occurred alongside substantial social and political upheaval [1]. In the initial stages, health authorities across the globe implemented a range of public health interventions aimed at mitigating the virus's spread. These measures include social distancing, mask wearing, quarantine measures, closure of public spaces and businesses, and vaccination campaigns. The success of these measures largely relied on the willingness of citizens to adopt and cooperate in order to keep themselves and their communities safe. Just as these measures varied in their duration and intensity across countries and jurisdictions, the willingness of individuals and communities to adopt and sustain them has also varied.

In times of crisis, the propensity for communities to unite under a common cause is a well-observed phenomenon, emphasizing the crucial role of global collaboration and coordinated responses. Solidarity and social cohesion emerge as pivotal factors in deciphering the dynamics of individual and collective behavior in such periods. Solidarity can be defined as a series of actions leading from a sense of a shared experience and a desire to take care of others, particularly others who might be more vulnerable [2]. Feelings of solidarity may in turn lead to actions taken among individuals, groups, and institutions. For example, in the context of the pandemic, individual actions such as mask wearing and physical distancing were encouraged, while institutional actions included financial support for people experiencing job loss in some jurisdictions. Shönweitz et al. [2] described solidarity as a 'practice' with four characteristics. First, solidarity involves costs or direct action (e.g., financial, social, psychological), distinguishing it from strictly ideology or sentiment. Second, solidarity comes from shared experiences and contexts, which differentiates it from charitable acts. Third, solidarity is facilitated by a sense of reciprocity. Finally, solidarity is separate from acts resulting from friendship, love, or other profound relationships or feelings.

Strong levels of solidarity may in turn lead to increased social cohesion [3,4], which is crucial in crisis scenarios if local communities are to be able to implement efficient actions, promote community resilience and help overcome future challenges. Social cohesion has been defined in various ways, including as "the degree of social connectedness and solidarity between different community groups within a society, as well as the level of trust and connectedness between individuals and across community groups" [5]. Silveira et al. [6] note that despite the myriad definitions for the concept, there seems to be consensus that social cohesion is "an indicator of

togetherness in a society, and as such, it revolves around levels of interaction and integration, civic engagement and identity.” A sense of belonging is identified as a key component of social cohesion, which involves feeling included within a specific context or environment [7].

The question of whether the adoption of pandemic precautions and other health behaviors (e.g., vaccination) is associated with social solidarity and cohesion has been examined as a means of understanding the variability in cooperation with and uptake of pandemic mitigation strategies. Liekefett et al. [8] found that concerns about personal protection and solidarity with at-risk groups contributed to this behavior during April and May of 2020 in Germany. Meanwhile, in a large international survey, Van Bavel et al. [9] found that a strong sense of national identity was associated with higher participation in public health measures and support for public health policies. A longitudinal qualitative study from Germany found that practices associated with feelings of solidarity decreased over time, and that participants’ enthusiasm for these practices declined. At the same time participants maintained a sense of the importance of institutional measures to promote solidarity related not only to the direct health impacts of the pandemic, but also the worsening socioeconomic challenges faced by many, including seniors and youth [2].

Recent research has indicated that societies with a strong level of social cohesion have seen better outcomes during the COVID-19 pandemic [10–16]. Evidence suggests, for example, that both social cohesion and actions of solidarity have increased following events such as natural disasters, financial crises, and mass tragedies [17–20]. In socially cohesive communities, a stronger sense of “shared fate” means that individuals are more likely to make sacrifices or accept public health measures [13,14]. Similar to the findings related to solidarity, however, evidence also indicates that social cohesion is likely to increase during times of crisis but then diminish as the crisis continues [17,19,21,22]. Furthermore, the research findings indicate that investments in social cohesion yield dividends in the form of stronger, more interconnected communities. These enhanced social networks, in turn, are better equipped to navigate and respond effectively to crisis situations [20].

Though several studies show shifts in solidarity and related behaviors during the pandemic, there appears to be limited evidence regarding the sociodemographic factors associated with feelings of solidarity and social cohesion. One study [23] found that solidarity during the pandemic, as demonstrated by adherence to COVID-19 safety measures during the first and second lockdowns in Germany, was positively associated with adherence to safety measures and with being middle aged; solidarity was negatively associated with depression symptoms, male gender, and older age. However, to the best of our knowledge, there is limited research exploring these relationships on a global scale.

## Current study

This study examines solidarity and health behaviors during the COVID-19 pandemic. We used cross-sectional data from a global survey conducted throughout 2021 that captured respondents’ perceptions of the pandemic and self-reported health behaviors. The primary aim of the study was to determine whether survey timing, sociodemographics, and/or health behaviors unrelated to COVID-19 were associated with feelings of solidarity during COVID-19. The secondary aim was to explore associations between solidarity and COVID-19-related health behaviors, such as self-reported social distancing, masking, and willingness to be vaccinated against COVID-19. The study was conducted in 11 economies (Canada, China, Ecuador, Hong Kong, Japan, Mexico, New Zealand, the Philippines, South Korea, Thailand, and the US) by an international team of more than 20 investigators that was formed through the Global Health Program of the Association of Pacific Rim Universities (APRU), a non-profit network of 60 universities from 19 economies of the Asia-Pacific. The APRU Global Health Program facilitates collaborative, multidisciplinary education, and research opportunities to address priority health concerns in the region.

## Data and methods

Data were obtained from a convenience sample via a global survey conducted by the APRU Global Health Program [24,25]. The survey was distributed online via social media and email. A panel of primary care providers, specialized

practitioners, and social epidemiologists completed pilot testing and validation of the survey. The survey was available in eight languages and included questions about demographics; socioeconomic status; health and wellbeing; experiences, behaviors, and perceptions related to COVID-19; and societal solidarity. Individuals were eligible to participate in the survey if they were 18 years of age or older; if they were capable of comprehending the purpose of the study; and if they provided informed consent. Individuals from 26 study sites responded to the survey between October 1<sup>st</sup>, 2020 and January 31<sup>st</sup>, 2022. Study sites included economies from the Asia-Pacific region [Australia, China, Hong Kong, India, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Russia, South Korea, Taiwan, Thailand]; the Americas [Canada, Colombia, Ecuador, Mexico, Peru]; Europe [France, Germany, Italy, the United Kingdom]; and the Middle East [Iraq, Oman, Saudi Arabia]; note that not all study sites are represented in the current analysis due to the exclusion of participants with missing data. The Survey and Behavioral Research Ethics Committee of the Chinese University of Hong Kong (SBRE-20–035) approved the study, with ethical clearance obtained for all 26 study sites. The data were stored securely on an online platform and the database was password encrypted and accessible only by designated research personnel. Assuming that half of participants would report positive feelings of solidarity, we aimed to collect more than 1,111 validated surveys to achieve a precision level of more than 0.03.

A total of 2,713 individuals participated in the survey. About 59% of these individuals ( $n = 1,595$ ) completed the solidarity scale—a key measure in this study, and thus a key inclusion criterion for the study sample. As this survey was administered to a cross-sectional convenience sample, advanced imputation methods were not feasible to preserve cases with missing data; thus, respondents with missing data on other measures of interest were excluded from the study sample. Of the 1,595 respondents who completed the solidarity scale, all respondents had complete data on the other outcomes of interest—the five COVID-19-related health behaviors. However, 12% were missing responses on other predictors of interest and were excluded from the study sample ( $n = 190$  respondents were missing a country of residence, which prohibited us from determining whether they completed the survey before or after the COVID-19 vaccine was widely available in their country, and also limited us from coding their region of residence;  $n = 5$  respondents did not report whether they had ever received a flu vaccine). An additional 54 respondents were missing data on one or more sociodemographic covariates and were excluded from the study sample. The study sample included 1,346 individuals with complete data on all outcomes, predictors of interest, and covariates, as described below.

## Measures

*Solidarity* was measured using a validated scale of three items [26] referring to feelings related to the COVID-19 pandemic in the past 14 days: (1) “I have felt there is greater solidarity and cohesion in our society and community,” (2) “I have felt I am an integral part of our society or community,” and (3) “I have felt our nation is growing closer together.” Respondents rated their agreement with each statement on a Likert scale of 1 (not at all) to 5 (very much agree), and responses to the three items were averaged ( $\alpha = 0.80$ ). A dichotomous indicator of solidarity was created by including positive scores in one category (average score greater than 3, coded 1), and combining negative and neutral scores into a second category (average score less than or equal to 3, coded 0).

Five *COVID-19-related health behaviors* were considered as outcomes of interest. The first four behaviors were measured with single items following the question stem: “During the last 14 days, which of the following measures have you taken to prevent infection from COVID-19?” (1) Social distancing was based on the item “Ensured physical distancing in public.” (2) Staying home from work/school was based on the item “Stayed at home from work/school.” (3) Skipping an event was based on the item “Avoided a social event I wanted to attend.” (4) Masking *in public* was based on the item “Wore a mask in public.” Respondents rated each item on a Likert scale of 1 (not at all) to 5 (very much). Responses greater than 3 were considered to endorse the health behavior (coded 1), and responses less than or equal to 3 were considered to *not* endorse the health behavior (coded 0). The fifth behavior, *willing to get the COVID-19 vaccine*, was based on a single question: for respondents completing the survey before a COVID-19 vaccine was available, “Are you

willing to receive the COVID-19 vaccine when one becomes available?” and for respondents completing the survey after a COVID-19 vaccine was available, “Are you willing to receive the COVID-19 vaccine?” Respondents rated their willingness on a Likert scale of 1 (strongly disagree) to 5 (strongly agree); responses greater than 3 were considered as willing to receive the vaccine (coded 1), and responses less than or equal to 3 were considered as *not* willing to receive the vaccine (coded 0). Note that these outcome measures were taken from Rek et al. [26] and the World Health Organization’s tool for behavioral insights on COVID-19 [27].

*Covariates* were included to control for several potentially confounding factors. We controlled for survey timing in two ways: first, considering *month of survey completion*; and second, considering whether a respondent *completed the survey after the COVID-19 vaccine was made available to all adults in the respondent’s country of residence* (yes = 1, no = 0). For the latter, internet searches were conducted to identify the date that a COVID-19 vaccine was available to all adults for each country represented in the analytic sample; estimated dates were used for several countries when exact dates of general availability could not be identified. Dates of COVID-19 vaccine availability for each study site represented in the analytic sample are included in [S1 Tables](#).

Previous literature reveals that age, sex, education, and income are associated with practicing COVID-19 prevention measures, such as social distancing and wearing masks in public [28–38]. Thus, we additionally controlled for sociodemographics, including region of residence (East, including respondents residing in countries in the Asia-Pacific region except Australia, and West, including respondents residing in countries in the Americas, Europe, and Australia); age category (18–29, 30–39, 40–49, 50 and over); sex (male, female); education (less than 10 years, 10–12 years, more than 12 years); household composition (living alone, living with family, living with roommates, other); employment (full-time employed, part-time employed, self-employed, retired, student, not employed but not student, caregiver or other); financial situation in the past 6 months (decreased, stayed the same, increased, don’t know); whether the respondent was receiving welfare at the time of survey completion (yes/no); and urban-rural status (rural area, rural-urban fringe, urban area). Lastly, we controlled for previous health behaviors that may predict feelings of solidarity and COVID-19-related health behaviors, specifically whether the respondent reported ever having a vaccine against influenza (yes/no).

## Analysis

First, we computed descriptive statistics for the full analytic sample, and disaggregated among respondents with positive feelings of solidarity and respondents with negative/neutral feelings of solidarity. Second, we conducted a logistic regression model predicting solidarity as a binary outcome (“Outcome 1”), including survey timing and covariates as predictors. Third, separate logistic regression models were specified to predict the five COVID-19-related health behaviors of interest (“Outcomes 2–6”). Three models were analyzed for each outcome: Model A was unadjusted and included solidarity as the only predictor; Model B was partially adjusted, including solidarity, availability of the COVID-19 vaccine at the time of survey completion, and whether respondent reported ever receiving a flu shot as predictors; and Model C was fully adjusted, including the three predictors from Model B as well as all covariates previously described.

## Results

### Descriptive statistics

Of the 1,346 respondents, just over half of the analytic sample reported positive feelings of solidarity (53.1%;  $n = 714$ ). The majority of the sample endorsed each of the five COVID-19-related health behaviors of interest: 85.2% of respondents ( $n = 1,147$ ) reported social distancing; 58.3% ( $n = 784$ ) reported staying home from work/school; 59.7% ( $n = 804$ ) reported skipping an event; 93.5% ( $n = 1,259$ ) reported masking in public; and 80.6% of respondents ( $n = 1,085$ ) were willing to get the COVID-19 vaccine. Close to two-thirds of respondents (61.5%;  $n = 828$ ) completed the survey after the COVID-19 vaccine was widely available in their country of residence. [Table 1](#) shows the descriptive statistics for the analytic sample, disaggregated by feelings of solidarity.



**Table 1. COVID-19-related health behaviors, survey timing, and sociodemographics of participants by feeling of solidarity.**

	All respondents (N=1346)	Positive feelings of solidarity (n =714)	Negative/neutral feelings of solidar- ity (n =632)	p-value
Characteristic	n (%)	n (%)	n (%)	
COVID-19-related health behaviors:				
Reported social distancing	1147 (85.2)	627 (87.8)	520 (82.3)	<b>0.0043</b>
Reported staying home from work/school	784 (58.3)	374 (52.4)	410 (64.9)	<b>&lt; 0.001</b>
Reported skipping an event	804 (59.7)	426 (59.7)	378 (59.8)	0.9565
Reported masking in public	1259 (93.5)	689 (96.5)	570 (90.2)	<b>&lt; 0.001</b>
Willing to get the COVID-19 vaccine	1085 (80.6)	576 (80.7)	509 (80.5)	0.9504
Month of survey completion:				<b>&lt; 0.001</b>
January 2021	306 (22.7)	224 (31.4)	82 (13.0)	
February 2021	59 (4.4)	37 (5.2)	22 (3.5)	
March 2021	34 (2.5)	16 (2.2)	18 (2.9)	
April 2021	54 (4.0)	37 (5.2)	17 (2.7)	
May 2021	30 (2.2)	19 (2.7)	11 (1.7)	
June 2021	107 (8.0)	59 (8.3)	48 (7.6)	
July 2021	6 (0.5)	4 (0.6)	2 (0.3)	
August 2021	43 (3.2)	17 (2.4)	26 (4.1)	
September 2021	121 (9.0)	57 (8.0)	64 (10.1)	
October 2021	399 (29.6)	164 (23.0)	235 (37.2)	
November 2021	26 (1.9)	13 (1.8)	13 (2.1)	
December 2021	8 (0.6)	2 (0.3)	6 (1.0)	
January 2022	153 (11.4)	65 (9.1)	88 (13.9)	
Completed survey after COVID-19 vaccine was made available to all adults in respondent's country of residence	828 (61.5)	361 (50.6)	467 (73.9)	<b>&lt; 0.001</b>
Region of residence:				<b>&lt; 0.001</b>
East (Asia)	987 (73.4)	555 (77.8)	432 (68.4)	
West (Americas, Australia, Europe)	358 (26.6)	158 (22.2)	200 (31.6)	
Age category				<b>0.0018</b>
18–29	971 (72.1)	489 (68.5)	482 (76.3)	
30–39	195 (14.5)	111 (15.5)	84 (13.3)	
40–49	95 (7.1)	54 (7.6)	41 (6.5)	
50 and over	85 (6.3)	60 (8.4)	25 (3.9)	
Sex				0.6524
Male	447 (33.2)	241 (33.8)	206 (32.6)	
Female	899 (66.8)	473 (66.2)	426 (67.4)	
Education				0.3151
Less than 10 years	47 (3.5)	27 (3.8)	20 (3.2)	
10–12 years	222 (16.5)	108 (15.1)	114 (18.0)	
More than 12 years	1077 (80.0)	579 (81.1)	498 (78.8)	
Household composition				<b>0.0054</b>
Living alone	117 (8.7)	66 (9.2)	51 (8.1)	
Living with family	1083 (80.4)	552 (77.3)	531 (84.0)	
Living with roommates	133 (9.9)	89 (12.5)	44 (7.0)	
Other	13 (1.0)	7 (1.0)	6 (0.9)	
Employment				<b>&lt; 0.001</b>

(Continued)

**Table 1.** (Continued)

	All respondents (N=1346)	Positive feelings of solidarity (n = 714)	Negative/neutral feelings of solidar- ity (n = 632)	p-value
Full-time employed	506 (37.6)	311 (43.6)	195 (30.9)	
Part-time employed	64 (4.8)	27 (3.8)	37 (5.8)	
Self-employed	38 (2.8)	14 (2.0)	24 (3.8)	
Retired	13 (1.0)	12 (1.7)	1 (0.2)	
Student	668 (49.6)	323 (45.2)	345 (54.6)	
Not employed but not student	30 (2.2)	16 (2.2)	14 (2.2)	
Caregiver or other	27 (2.0)	11 (1.5)	16 (2.5)	
Financial situation in past 6 months				0.4621
Decreased	311 (23.1)	159 (22.3)	152 (24.0)	
Stayed the same	695 (51.6)	369 (51.7)	326 (51.6)	
Increased	246 (18.3)	140 (19.6)	106 (16.8)	
Don't know	94 (7.0)	46 (6.4)	48 (7.6)	
Receiving welfare at the time of survey completion	305 (22.7)	175 (24.5)	130 (20.6)	0.0848
Urban-rural status				0.1078
Rural area	374 (27.8)	182 (25.5)	192 (30.4)	
Rural-urban fringe	114 (8.5)	59 (8.3)	55 (8.7)	
Urban area	858 (63.7)	473 (66.2)	385 (60.9)	
Reported ever having a vaccination against influenza	771 (57.3)	403 (56.4)	368 (58.2)	0.5087

Note. N = 1346 participants who had complete data on outcome and all predictors; **bold font** indicates a significant difference in positive versus negative/neutral feelings of solidarity among respondents at p-value < 0.05, as indicated by chi-square tests.

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Disaggregating by feelings of solidarity, more respondents who reported positive feelings of solidarity also reported social distancing (87.8%) and masking in public (96.5%) compared to those who reported negative/neutral feelings of solidarity (82.3% and 90.2%, respectively). More respondents who reported negative/neutral feelings of solidarity, compared to those with positive feelings of solidarity, reported staying home from work/school (64.9% versus 52.4%) and completing the survey after the COVID-19 vaccine was widely available in their country of residence (73.9% versus 50.6%). Respondents with positive versus negative/neutral feelings of solidarity also differed in terms of region of residence, age category, household composition, and employment, as detailed in [Table 1](#).

### Predictors of positive feelings of solidarity

The logistic regression model predicting positive feelings of solidarity (versus negative/neutral feelings of solidarity; Outcome 1) showed significant associations with survey timing, region of residence, age category, and employment (see [Table 2](#)). Specifically, individuals who completed the survey after the COVID-19 vaccine was widely available in their country of residence had 0.5 times the odds (95% confidence interval [CI] 0.3, 0.8) of reporting positive feelings of solidarity compared to those who completed the survey before the COVID-19 vaccine was widely available. Individuals residing in the East (i.e., economies in the Asia-Pacific region, except Australia) had 2.0 times the odds (95% CI 1.3, 3.0) of reporting positive feelings of solidarity compared to individuals residing in the West (i.e., economies in the Americas, Europe, and Australia). Individuals between the ages of 30 and 39, between the ages of 40 and 49, and ages 50 and over had 1.5 times the odds (95% CI 1.0, 2.2), 1.7 times the odds (95% CI 1.0, 2.9), and 3.2 times the odds (95% CI 1.8, 5.7), respectively, of reporting positive feelings of solidarity compared to individuals between the ages of 18 and 29. Further, individuals who were part-time employed and self-employed had 0.5 times the odds (95% CI 0.3, 0.9) and

**Table 2. Results of logistic regression predicting positive feelings of solidarity (Outcome 1).**

Predictor	Odds Ratio (95% CI)
Month of survey completion (ref= January 2022)	
January 2021	<b>3.32 (1.24, 8.87)</b>
February 2021	2.40 (0.80, 7.25)
March 2021	1.02 (0.35, 2.97)
April 2021	2.98 (0.97, 9.13)
May 2021	2.74 (0.81, 9.30)
June 2021	<b>3.56 (1.79, 7.11)</b>
July 2021	4.37 (0.62, 30.90)
August 2021	0.95 (0.34, 2.68)
September 2021	2.73 (1.41, 5.28)
October 2021	1.41 (0.90, 2.20)
November 2021	1.91 (0.80, 4.57)
December 2021	0.65 (0.12, 3.38)
Completed survey after COVID-19 vaccine was made available to all adults in respondent's country of residence	<b>0.48 (0.28, 0.82)</b>
Region of residence (ref= West)	
East	<b>1.95 (1.26, 3.04)</b>
Age category (ref= 18–29)	
30–39	<b>1.50 (1.00, 2.23)</b>
40–49	<b>1.74 (1.04, 2.92)</b>
50 and over	<b>3.21 (1.80, 5.71)</b>
Sex (ref= Male)	
Female	0.99 (0.77, 1.28)
Education (ref= Less than 10 years)	
10–12 years	1.58 (0.82, 3.02)
More than 12 years	1.26 (0.90, 1.77)
Household composition (ref= Living alone)	
Living with family	1.15 (0.75, 1.77)
Living with roommates	1.62 (0.92, 2.84)
Other	0.84 (0.23, 3.06)
Employment (ref= Full-time employed)	
Part-time employed	<b>0.50 (0.27, 0.90)</b>
Self-employed	<b>0.37 (0.18, 0.79)</b>
Retired	4.26 (0.51, 35.44)
Student	0.89 (0.63, 1.26)
Not employed but not student	0.72 (0.32, 1.63)
Caregiver or other	0.66 (0.28, 1.55)
Financial situation in past 6 months (ref= Decreased)	
Stayed the same	0.80 (0.60, 1.08)
Increased	0.79 (0.54, 1.16)
Don't know	0.75 (0.46, 1.24)
Receiving welfare at the time of survey completion	1.45 (0.97, 2.06)
Urban-rural status (ref= Rural area)	
Rural-urban fringe	1.12 (0.70, 1.78)
Urban area	0.98 (0.73, 1.32)
Reported ever having a vaccination against influenza	1.07 (0.83, 1.39)

Note. N = 1346 participants who had complete data on outcome and all predictors; **bold font** indicates a statistically significant odds ratio.

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0.4 times the odds (95% CI 0.2, 0.8), respectively, of reporting positive feelings of solidarity compared to those who were full-time employed.

### Solidarity and survey timing as predictors of COVID-19-related health behaviors

Solidarity predicted three of the five COVID-19-related health behaviors of interest, summarized in [Table 3](#). In the fully adjusted logistic regression model predicting social distancing (versus not social distancing; Outcome 2), individuals who reported positive feelings of solidarity had 2.1 times the odds (95% CI 1.5, 2.9) of also reporting social distancing compared to those who reported negative/neutral feelings of solidarity (full results of Outcome 2—Model C in [S1 Tables](#)). This significant association was robust across Model A (unadjusted model) and Model B (partially adjusted model) as well.

The next set of logistic regression models predicted staying home from work/school (versus not staying home from work/school; Outcome 3). Although solidarity was associated with reporting staying home from work/school in the unadjusted Model A (OR=0.6; 95% CI 0.5, 0.7), this association was not significant in Model B or Model C (full results of Outcome 3—Model C in [S1 Tables](#)).

In the fully adjusted logistic regression model predicting skipping an event one wanted to attend (versus not skipping an event; Outcome 4), individuals who reported positive feelings of solidarity had 1.4 times the odds (95% CI 1.1, 1.8) of reporting skipping an event compared to those who reported negative/neutral feelings of solidarity (full results of Outcome 4—Model C in [S1 Tables](#)). This significant association was robust across Model A (unadjusted model) and Model B (partially adjusted model). In Model C, individuals who reported ever having a vaccine against influenza had 1.4 times the odds (95% CI 1.1, 1.9) of reporting skipping an event compared to those who reported never having a vaccine against influenza; this association was also robust in the partially adjusted Model B.

In the fully adjusted logistic regression model predicting masking in public (versus not masking in public; Outcome 5), individuals who reported positive feelings of solidarity had 3.3 times the odds (95% CI 1.9, 5.7) of reporting masking in public compared to those who reported negative/neutral feelings of solidarity (full results of Outcome 5—Model C in [S1 Tables](#)). Again, this significant association was robust across Model A and Model B. Additionally, in Model C, individuals who reported ever having a vaccine against influenza had 2.2 times the odds (95% CI 1.2, 3.8) of reporting masking in public compared to those who reported never having a vaccine against influenza; this association was robust in Model B as well.

The final set of logistic regression models predicted willingness to get the COVID-19 vaccine (versus not willing to get the COVID-19 vaccine; Outcome 6). Solidarity was not associated with Outcome 6 in Model A, Model B, or Model C (full results of Outcome 6—Model C in [S1 Tables](#)). However, in Model C, individuals who completed the survey after the COVID-19 vaccine was widely available in their country of residence had 1.9 times the odds (95% CI 1.3, 2.6) of being willing to get the COVID-19 vaccine compared to those who completed the survey before the vaccine was widely available. Note that surveys administered after the COVID-19 vaccine was widely available did not ask whether individuals had already received the COVID-19 vaccine. Further, individuals who reported ever having a vaccine against influenza had 1.9 times the odds (95% CI 1.3, 2.6) of being willing to get the COVID-19 vaccine compared to those who reported never having a vaccine against influenza. These associations were significant in the partially adjusted Model B as well.

## Discussion

Our study findings shed light on feelings of community solidarity and how it related to adoption of public health preventive behaviors during the COVID-19 pandemic in a multi-national sample of respondents. First, our results demonstrated that about half of our respondents reported positive feelings of solidarity. Respondents with positive feelings of solidarity were more likely to be employed in a full-time position. We also found an association between positive feelings of solidarity and being aged 30 years or over. Research from Germany during the COVID-19 pandemic similarly showed a positive association between solidarity and middle age, but found lower solidarity among adults over 64 years. Kaup et al. [\[23\]](#) suggest

**Table 3. Results of logistic regression models predicting COVID-19-related health behaviors.**

Predictor	Model A Unadjusted Odds Ratio (95% CI)	Model B Partially Adjusted Odds Ratio (95% CI)	Model C Fully Adjusted Odds Ratio (95% CI)
<i>Outcome 2: Reported social distancing</i>			
Positive feelings of solidarity (ref = Negative/Neutral)	<b>1.55 (1.15, 2.10)</b>	<b>1.83 (1.33, 2.52)</b>	<b>2.05 (1.46, 2.89)</b>
COVID-19 vaccine available <sup>a</sup> (ref = Vaccine not available)	—	<b>1.90 (1.39, 2.61)</b>	1.07 (0.28, 4.14)
Ever vaccinated against influenza <sup>b</sup> (ref = Never vaccinated)	—	1.12 (0.82, 1.52)	1.20 (0.84, 1.70)
<i>Outcome 3: Reported staying home from work/school</i>			
Positive feelings of solidarity (ref = Negative/Neutral)	<b>0.60 (0.48, 0.74)</b>	0.97 (0.75, 1.26)	1.30 (0.97, 1.74)
COVID-19 vaccine available <sup>a</sup> (ref = Vaccine not available)	—	<b>9.78 (7.52, 12.74)</b>	1.58 (0.63, 3.95)
Ever vaccinated against influenza <sup>b</sup> (ref = Never vaccinated)	—	0.91 (0.71, 1.18)	1.13 (0.83, 1.53)
<i>Outcome 4: Reported skipping an event</i>			
Positive feelings of solidarity (ref = Negative/Neutral)	<b>1.99 (1.09, 2.99)</b>	<b>1.32 (1.04, 1.67)</b>	<b>1.40 (1.08, 1.80)</b>
COVID-19 vaccine available <sup>a</sup> (ref = Vaccine not available)	—	<b>3.03 (2.39, 3.85)</b>	1.56 (0.65, 3.75)
Ever vaccinated against influenza <sup>b</sup> (ref = Never vaccinated)	—	<b>1.29 (1.03, 1.62)</b>	<b>1.44 (1.11, 1.87)</b>
<i>Outcome 5: Reported masking in public</i>			
Positive feelings of solidarity (ref = Negative/Neutral)	<b>3.00 (1.86, 4.83)</b>	<b>2.86 (1.75, 4.67)</b>	<b>3.31 (1.94, 5.66)</b>
COVID-19 vaccine available <sup>a</sup> (ref = Vaccine not available)	—	0.79 (0.48, 1.29)	0.92 (0.16, 5.24)
Ever vaccinated against influenza <sup>b</sup> (ref = Never vaccinated)	—	<b>1.39 (0.89, 2.16)</b>	<b>2.16 (1.24, 3.76)</b>
<i>Outcome 6: Willing to get the COVID-19 vaccine</i>			
Positive feelings of solidarity (ref = Negative/Neutral)	1.01 (0.77, 1.32)	1.15 (0.87, 1.53)	1.38 (0.99, 1.89)
COVID-19 vaccine available <sup>a</sup> (ref = Vaccine not available)	—	<b>1.64 (1.24, 2.18)</b>	<b>1.26 (1.08, 1.45)</b>
Ever vaccinated against influenza <sup>b</sup> (ref = Never vaccinated)	—	<b>1.78 (1.35, 2.34)</b>	<b>1.86 (1.34, 2.57)</b>

Note.

<sup>a</sup>Respondent completed the survey after COVID-19 vaccine was made available to all adults in the respondent's country of residence;

<sup>b</sup>Respondent reported that they received a vaccine against influenza at least once prior to survey completion. N = 1346 participants who had complete data on outcome and all predictors; **bold font** indicates a statistically significant odds ratio. Full results from Model C can be found in [S1 Tables](#).

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that the association between middle age and positive feelings of solidarity could be explained by having high caretaking responsibilities, for both children and older parents, in middle age. Unlike the findings from Germany, older adults in our sample also demonstrated high levels of solidarity. It is possible that this is due to the strong collectivist and family orientation among participants from Eastern societies; we found that respondents from Eastern countries were also more likely to report positive feelings than those in Western countries. Interestingly, no association was found between positive feelings of solidarity and sex, education, household composition, financial situation, or urban versus rural residence.

We also found that the majority of our participants reported adoption of (or willingness to adopt) the five public health measures of interest that were intended to reduce COVID-19 exposure and transmission. This is in line with other research conducted with a variety of populations, which has found that a majority of respondents reported adopting COVID-19 preventive public health measures such as physical distancing, wearing a mask, being willing to participate in contact tracing programs, and implementing personal hygiene practices, including studies from China [39], Canada [40,41], Hong Kong [42], the US [28,41,43], South Korea [37,38], and Malaysia [44].

The timing of when a participant completed the survey was an important factor in predicting feelings of solidarity. We found that those who completed the survey later in the pandemic—after the COVID-19 vaccine was widely available in their country of residence—were less likely to report positive feelings of solidarity than those who completed the survey earlier—before the vaccine was widely available. This is consistent with other work on solidarity during crises, which has shown that feelings of solidarity often increase during the initial phase of a crisis, due to an initial sense of embarking upon a shared negative experience [22,45,46]. However, as occurred during the COVID-19 pandemic, these widespread feelings of solidarity are short-lived and often devolve into feelings of social fragmentation [17,20,21], as demonstrated by rises in racism [47,48] and mistrust in public health measures in many regions [20,49].

We also found that individuals residing in countries categorized as the East were more likely to report positive feelings of solidarity compared to individuals residing in countries categorized as the West. The differences in East versus West may be explained by cultural orientations towards collectivism (Eastern societies) or individualism (Western societies), which often shape beliefs, attitudes, norms, and values [50,51]. “Collectivism” is a term that refers to viewing people as interdependent, which leads to prosocial behaviors intended to benefit the community as a whole [50]. Western societies tend to be individualistic, favoring individual freedom, and thus decisions in these societies may be more driven by self-interest [52]. Several studies have examined individualism versus collectivism during the COVID-19 pandemic and have found a negative relationship between individualism and uptake of prosocial public health behaviors [35,52–60]. For example, Gelfand et al.’s [61] cross-national comparative study found that countries with “tight” cultures such as China, South Korea, and Singapore (in which social norms favor authority, social control, and collective welfare over individual rights) were more successful at implementing pandemic control measures and therefore had significantly lower cases and deaths than “looser societies,” such as the US. Further, Vietnam successfully used messages promoting solidarity and social responsibility to encourage adoption of public health preventive behaviors during the COVID-19 pandemic, capitalizing on feelings of social cohesion in this collectivistic society [62].

Collectivism may be protective against COVID-19 because of its association with conformity to social norms relating to public health prevention behaviors. Previous research across various disciplines has found subjective norms and social pressure to be important factors in predicting COVID-19 public health behaviors (such as vaccination, wearing masks, or complying with stay-at-home orders) [41,59,63–65]. Studies have found higher compliance rates with such policies in settings where perceived public approval is high or where perceptions of peer pressure are strong [10,65–68]. Relatedly, our results indicate that feelings of solidarity were positively associated with adoption of preventive behaviors relating to COVID-19. Those who reported positive feelings of solidarity also reported higher levels of social distancing and masking in public. Furthermore, our results showed that positive feelings of solidarity predicted social distancing, skipping an event, and masking in public. These findings are consistent with a growing body of research demonstrating that feelings of community solidarity and social cohesion are associated with adoption of public health measures [10–13,15,16].

The association between feelings of solidarity and adherence to public health measures suggests that efforts to promote solidarity can be beneficial during widespread public health emergencies. In a study in Tamil Nadu, India, high levels of trust and confidence in public institutions, which is identified by Bottoni [69] as a dimension of social cohesion, led to higher degrees of cooperation with public health measures [70]. The authors recommended several strategies to promote public trust during times of crisis, including strong communication strategies that are transparent but measured, avoidance

of stigmatizing practices or language which may lead to reluctance to test, and promotion of community engagement strategies that foster a sense of ownership by communities [70]. A study among Orthodox Jewish communities in Antwerp, Belgium [71] found that although there were high levels of mistrust towards the public health system, engagement between health authorities and community leaders early in the pandemic helped these communities to adopt culturally appropriate approaches to prevention. These examples demonstrate the need for direct community engagement to promote feelings of trust and solidarity, particularly among isolated or marginalized communities.

Adopting public health preventive behaviors during the pandemic not only protected communities as a whole but also had benefits to individuals within those communities [46,65,72]. High levels of community solidarity are associated with individual resiliency, optimism, and coping in times of crisis [10–16]. Studies found better individual health outcomes during the pandemic in closer-knit neighborhoods [73–77]. For example, a study of Orthodox Jewish communities in the US, Belgium, and Israel found that a strong sense of social support, social identity, and feelings of belonging within these communities were associated with higher resilience, lower levels of psychological distress, and fewer negative personal impacts during the pandemic [71]. In Argentina, Carter and Cordero [10] found that optimism, resilient attitudes, and personal competence to face the pandemic were significantly higher among participants who perceived strong social ties in their neighborhoods. Further, those who perceived high neighborhood cohesion had more confidence in their neighbors' compliance with public health measures. In the UK, Lalot et al. [20] found that higher levels of social cohesion related to greater subjective well-being and optimism for the future.

We found that people who had previously adopted public health measures like the influenza vaccination were also more likely to adopt current COVID-19 pandemic measures, including skipping an event, masking in public, and being willing to get the COVID-19 vaccine. This finding aligns with recent studies demonstrating that previous influenza vaccination predicted COVID-19 prevention behaviors in Israel [78], South Korea [37], Italy [79], and the US [80–82]. Therefore, along with government mandates, public health campaigns that encourage the public to practice general preventive behaviors may be important in times of crisis.

## Limitations

This study has several limitations. First, it is a cross-sectional convenience sample and may not be generalizable to a larger population. The survey did not include questions about field of employment or work environment, and we were thus unable to control for field of employment (and, in particular, whether a respondent worked in health care or public health) in our regression models. Further, the online administration of the survey—and the recruitment of participants, specifically via social media—may have excluded those without immediate access to the internet, as well as those who were not active on social media. However, internet use is common in the countries sampled, and the sample of respondents gives us an important snapshot into feelings and behaviors during the pandemic. Second, we collected the data over about 15 months, and thus the local COVID-19 situation and personal knowledge and attitudes may have varied across different timepoints, but we controlled for survey timing in two ways in our regression models to account for these likely variations. Third, there are many ways to measure feelings of community solidarity; while we used a validated three-item measure, this measure did not include all possible dimensions of solidarity. Lastly, we coded solidarity as a dichotomous variable, and thus were unable to distinguish between “neutral” and “negative” feelings of solidarity, but this coding allowed us to focus on “positive” feelings of solidarity in a binary context.

## Conclusions

To conclude, our findings show that individuals reporting positive feelings of solidarity were more likely to adopt public health preventive measures during the COVID-19 pandemic. Governments and communities should take measures to foster solidarity and resilience among their residents by promoting prosocial behaviors in local neighborhoods and communities, strengthening community social support [52,62], and engaging with communities directly to ensure prevention

strategies are appropriate [70,71]. Promoting engagement in prosocial behaviors as a social norm could create an upward spiral for people to support each other during difficult times and could improve individuals' physical and mental health.

## NOTES

We use the term “economies” instead of “countries” to be consistent with APEC guidelines (APEC, 2024)

## Supporting information

**S1 Tables.** S1 Table 1: Estimated dates of widespread COVID-19 vaccine availability for countries with residents included in study sample. S1 Table 2: Results of logistic regression predicting social distancing during COVID-19. S1 Table 3: Results of logistic regression predicting staying home from work/school during COVID-19. S1 Table 4: Results of logistic regression predicting skipping an event one wanted to attend during COVID-19. S1 Table 5: Results of logistic regression predicting masking in public during COVID-19. S1Table 6: Results of logistic regression predicting willingness to get the COVID-19 vaccine.

(DOCX)

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## References

1. Bonotti M, Zech ST. The human, economic, social, and political costs of COVID-19. Recovering civility during COVID-19. 2021;1–36.
2. Schönweitz FB, Zimmermann BM, Hangel N, Fiske A, McLennan S, Sierawska A, et al. Solidarity and reciprocity during the COVID-19 pandemic: a longitudinal qualitative interview study from Germany. BMC Public Health. 2024;24(1):23. <https://doi.org/10.1186/s12889-023-17521-7> PMID: 38166737
3. Durkheim E. Le suicide, étude de sociologie. Ancient Philosophy (Misc). 1898;8:448.
4. Juul S. Solidarity and social cohesion in late modernity: A question of recognition, justice and judgement in situation. European Journal of Social Theory. 2010;13(2):253–69.
5. Jewett RL, Mah SM, Howell N, Larsen MM. Social Cohesion and Community Resilience During COVID-19 and Pandemics: A Rapid Scoping Review to Inform the United Nations Research Roadmap for COVID-19 Recovery. Int J Health Serv. 2021;51(3):325–36. <https://doi.org/10.1177/0020731421997092> PMID: 33827308
6. Silveira S, Hecht M, Matthaeus H, Adli M, Voelke MC, Singer T. Coping with the COVID-19 Pandemic: Perceived Changes in Psychological Vulnerability, Resilience and Social Cohesion before, during and after Lockdown. Int J Environ Res Public Health. 2022;19(6):3290. <https://doi.org/10.3390/ijerph19063290> PMID: 35328981
7. Hagerty BM, Williams RA, Coyne JC, Early MR. Sense of belonging and indicators of social and psychological functioning. Arch Psychiatr Nurs. 1996;10(4):235–44. [https://doi.org/10.1016/s0883-9417\(96\)80029-x](https://doi.org/10.1016/s0883-9417(96)80029-x) PMID: 8799050
8. Liekefett L, Becker J. Compliance with governmental restrictions during the coronavirus pandemic: A matter of personal self-protection or solidarity with people in risk groups?. Br J Soc Psychol. 2021;60(3):924–46. <https://doi.org/10.1111/bjso.12439> PMID: 33393680



9. Van Bavel JJ, Cichocka A, Capraro V, Sjøstad H, Nezlek JB, Pavlović T, et al. National identity predicts public health support during a global pandemic. *Nat Commun*. 2022;13(1):517. <https://doi.org/10.1038/s41467-021-27668-9> PMID: [35082277](#)
10. Carter ED, Cordero ML. Salir Adelante: Social capital and resilience during the Covid-19 pandemic in Argentina. *Health Place*. 2022;77:102870. <https://doi.org/10.1016/j.healthplace.2022.102870> PMID: [35933852](#)
11. Boyd N, Davis M. Neighbors help in a pandemic. *Erasmus Journal for Philosophy and Economics*. 2021;14(1).
12. Drury J, Carter H, Ntontis E, Guven ST. Public behaviour in response to the COVID-19 pandemic: understanding the role of group processes. *BJPsych Open*. 2020;7(1):e11. <https://doi.org/10.1192/bjo.2020.139> PMID: [33283693](#)
13. Jackson J, Bradford B. Us and Them: On the Motivational Force of Formal and Informal Lockdown Rules. *LSE Public Policy Review*. 2021;1(4). <https://doi.org/10.31389/lseppr.24>
14. Reicher S, Bauld L. From the “fragile rationalist” to “collective resilience”: what human psychology has taught us about the COVID-19 pandemic and what the COVID-19 pandemic has taught us about human psychology. *J R Coll Physicians Edinb*. 2021;51(S1):S12–9. <https://doi.org/10.4997/JRCPE.2021.236> PMID: [34185033](#)
15. Reicher S, Stott C. On order and disorder during the COVID-19 pandemic. *Br J Soc Psychol*. 2020;59(3):694–702. <https://doi.org/10.1111/bjso.12398> PMID: [32609398](#)
16. Ritchie L, Gill D. Considering COVID-19 through the lens of hazard and disaster research. *Social Sciences*. 2021;10(7).
17. Hawdon J, Ryan J. Social Relations that Generate and Sustain Solidarity after a Mass Tragedy. *Social Forces*. 2011;89(4):1363–84. <https://doi.org/10.1093/sf/89.4.1363>
18. Borger V. How the Debt Crisis Exposes the Development of Solidarity in the Euro Area. *European Constitutional Law Review*. 2013;9(1):7–36. <https://doi.org/10.1017/s1574019612001022>
19. Calo-Blanco A, Kovářik J, Mengel F, Romero JG. Natural disasters and indicators of social cohesion. *PLoS One*. 2017;12(6):e0176885. <https://doi.org/10.1371/journal.pone.0176885> PMID: [28591148](#)
20. Lalot F, Abrams D, Broadwood J, Davies Hayon K, Platts-Dunn I. The social cohesion investment: Communities that invested in integration programmes are showing greater social cohesion in the midst of the COVID-19 pandemic. *J Community Appl Soc Psychol*. 2022;32(3):536–54. <https://doi.org/10.1002/casp.2522> PMID: [34230795](#)
21. Sweet S. The effect of a natural disaster on social cohesion: A longitudinal study. *International Journal of Mass Emergencies & Disasters*. 1998;16(3):321–31.
22. Drury J, Brown R, González R, Miranda D. Emergent social identity and observing social support predict social support provided by survivors in a disaster: Solidarity in the 2010 Chile earthquake. *European Journal of Social Psychology*. 2016;46(2):209–23.
23. Kaup T, Schweda A, Krakowczyk J, Dinse H, Skoda EM, Teufel M. Levels, Predictors, and Distribution of Interpersonal Solidarity during the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2022;19(4).
24. Samet J, Withers M. The APRU Global Health Program: Past and Future. *J Epidemiol*. 2016;26(4):166–70. <https://doi.org/10.2188/jea.JE20160049> PMID: [27052883](#)
25. Wong MCS, Huang J, Wang HHX, Yuan J, Xu W, Zheng Z-J, et al. Resilience level and its association with maladaptive coping behaviours in the COVID-19 pandemic: a global survey of the general populations. *Global Health*. 2023;19(1):1. <https://doi.org/10.1186/s12992-022-00903-8> PMID: [36597129](#)
26. Rek SV, Bühner M, Reinhard MA, Freeman D, Keeser D, Adorjan K, et al. The COVID-19 Pandemic Mental Health Questionnaire (CoPaQ): psychometric evaluation and compliance with countermeasures in psychiatric inpatients and non-clinical individuals. *BMC Psychiatry*. 2021;21(1):426. <https://doi.org/10.1186/s12888-021-03425-6> PMID: [34465319](#)
27. World Health Organization. WHO tool for behavioural insights on COVID-19. 2020.
28. Anderson KM, Stockman JK. Staying Home, Distancing, and Face Masks: COVID-19 Prevention among U.S. Women in The COPE Study. *Int J Environ Res Public Health*. 2020;18(1):180. <https://doi.org/10.3390/ijerph18010180> PMID: [33383745](#)
29. Barrett C, Cheung KL. Knowledge, socio-cognitive perceptions and the practice of hand hygiene and social distancing during the COVID-19 pandemic: a cross-sectional study of UK university students. *BMC Public Health*. 2021;21(1):426. <https://doi.org/10.1186/s12889-021-10461-0> PMID: [33648486](#)
30. Briscese G, Lacetera N, Macis M, Tonin M. Expectations, reference points, and compliance with COVID-19 social distancing measures. *J Behav Exp Econ*. 2023;103:101983. <https://doi.org/10.1016/j.socec.2023.101983> PMID: [36714370](#)
31. Charles G, Jain M, Caplan Y, Kemp H, Keisler A, Huang V. Increasing uptake of social distancing during COVID-19: machine learning strategies for targeted interventions. *Harvard Data Science Review*. 2020;4(1).
32. Chua CE, Kew GS, Demutska A, Quek S, Loo EXL, Gui H, et al. Factors associated with high compliance behaviour against COVID-19 in the early phase of pandemic: a cross-sectional study in 12 Asian countries. *BMJ Open*. 2021;11(8):e046310. <https://doi.org/10.1136/bmjopen-2020-046310> PMID: [34373296](#)
33. Haischer MH, Beilfuss R, Hart MR, Opielinski L, Wrucke D, Zircgaitis G. Who is wearing a mask? Gender-, age-, and location-related differences during the COVID-19 pandemic. *PLoS One*. 2020;15(10):e0240785.

34. Merkley E, Bridgman A, Loewen PJ, Owen T, Ruths D, Zhilin O. A Rare Moment of Cross-Partisan Consensus: Elite and Public Response to the COVID-19 Pandemic in Canada. *Canadian Journal of Political Science*. 2020;53(2):311–8.
35. Chung J-B, Kim BJ, Kim E-S. Mask-wearing behavior during the COVID-19 pandemic in Korea: The role of individualism in a collectivistic country. *Int J Disaster Risk Reduct*. 2022;82:103355. <https://doi.org/10.1016/j.ijdrr.2022.103355> PMID: 36249123
36. Hao F, Shao W, Huang W. Understanding the influence of contextual factors and individual social capital on American public mask wearing in response to COVID-19. *Health Place*. 2021;68:102537. <https://doi.org/10.1016/j.healthplace.2021.102537> PMID: 33636596
37. Hyun WI, Son YH, Jung SO. Infection preventive behaviors and its association with perceived threat and perceived social factors during the COVID-19 pandemic in South Korea: 2020 community health survey. *BMC Public Health*. 2022;22(1):1381. <https://doi.org/10.1186/s12889-022-13755-z> PMID: 35854280
38. Jang SH. Social-ecological factors related to preventive behaviors during the COVID-19 pandemic in South Korea. *PLoS One*. 2022;17(3):e0266264. <https://doi.org/10.1371/journal.pone.0266264> PMID: 35358264
39. Zhong B-L, Luo W, Li H-M, Zhang Q-Q, Liu X-G, Li W-T, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci*. 2020;16(10):1745–52. <https://doi.org/10.7150/ijbs.45221> PMID: 32226294
40. Parsons Leigh J, Fiest K, Brundin-Mather R, Plotnikoff K, Soo A, Sypes EE, et al. A national cross-sectional survey of public perceptions of the COVID-19 pandemic: Self-reported beliefs, knowledge, and behaviors. *PLoS One*. 2020;15(10):e0241259. <https://doi.org/10.1371/journal.pone.0241259> PMID: 33095836
41. Wang D, Marmo-Roman S, Krase K, Phanord L. Compliance with preventative measures during the COVID-19 pandemic in the USA and Canada: Results from an online survey. *Soc Work Health Care*. 2021;60(3):240–55. <https://doi.org/10.1080/00981389.2020.1871157> PMID: 33407057
42. Chan EYY, Kim JH, Kwok KO, Huang Z, Hung KKC, Wong ELY, et al. Population adherence to infection control behaviors during Hong Kong's first and third COVID-19 waves: A serial cross-sectional study. *International Journal of Environmental Research and Public Health*. 2021;18(21).
43. Nelson TL, Fosdick BK, Biela LM, Schoenberg H, Mast S, McGinnis E. Association Between COVID-19 Exposure and Self-Reported Compliance With Public Health Guidelines Among Essential Employees at an Institution of Higher Education in the US. *JAMA Netw Open*. 2021;4(7):e2116543.
44. Azlan AA, Hamzah MR, Sern TJ, Ayub SH, Mohamad E. Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS One*. 2020;15(5):e0233668.
45. Muldoon O. Collective trauma. In: Jetten J, Reicher SD, Haslam SA, Cruwys T. Together apart: The psychology of COVID-19. London: SAGE Publishing. 2020;84–8.
46. Abrams D, Lalot F, Hogg MA. Intergroup and intragroup dimensions of COVID-19: A social identity perspective on social fragmentation and unity. *Group Processes & Intergroup Relations*. 2021;24(2).
47. Addo IY. Double pandemic: racial discrimination amid coronavirus disease 2019. *Soc Sci Humanit Open*. 2020;2(1):100074. <https://doi.org/10.1016/j.ssaho.2020.100074> PMID: 34173502
48. Wong-Padoongpatt G, Barrita A, King A, Strong M. The slow violence of racism on Asian Americans during the COVID-19 pandemic. *Front Public Health*. 2022;10:958999. <https://doi.org/10.3389/fpubh.2022.958999> PMID: 36388334
49. Ojikutu BO, Bogart LM, Dong L. Mistrust, Empowerment, and Structural Change: Lessons We Should Be Learning From COVID-19. *Am J Public Health*. 2022;112:401–4.
50. Triandis HC. Individualism-collectivism and personality. *J Pers*. 2001;69(6):907–24. <https://doi.org/10.1111/1467-6494.696169> PMID: 11767823
51. Flynn AV. Solidarity and collectivism in the context of COVID-19. *Nurs Ethics*. 2022;29(5):1198–208. <https://doi.org/10.1177/09697330211072371> PMID: 35297695
52. Yu Y, Lau MMC, Lau JT. Positive association between individualism and vaccination resistance against COVID-19 vaccination among Chinese adults: Mediations via perceived personal and societal benefits. *Vaccines (Basel)*. 2021;9(11).
53. Castle C, Di Guilmi C, Stavrunova O. Individualism and collectivism as predictors of compliance with COVID-19 public health safety expectations. In: Department of Economic Working Paper Series, 2021.
54. Schneider CR, Dryhurst S, Kerr J, Freeman ALJ, Recchia G, Spiegelhalter D, et al. COVID-19 risk perception: a longitudinal analysis of its predictors and associations with health protective behaviours in the United Kingdom. *Journal of Risk Research*. 2021;24(3–4):294–313. <https://doi.org/10.1080/13669877.2021.1890637>
55. Xiao WS. The Role of Collectivism-Individualism in Attitudes Toward Compliance and Psychological Responses During the COVID-19 Pandemic. *Front Psychol*. 2021;12:600826. <https://doi.org/10.3389/fpsyg.2021.600826> PMID: 34777076
56. Jiang S, Wei Q, Zhang L. Individualism versus collectivism and the early-stage transmission of COVID-19. *Soc Indic Res*. 2022;164(2):791–821.
57. Mo Y, Park HS. COVID-19 and Public Masking Compliance in Korea: We-ness and Individualism-Collectivism at the Individual Level. *Health Commun*. 2023;38(6):1111–9. <https://doi.org/10.1080/10410236.2021.1993532> PMID: 34726984
58. Wang Z, Li Y, Xu R, Yang H. How culture orientation influences the COVID-19 pandemic: An empirical analysis. *Front Psychol*. 2022;13:899730. <https://doi.org/10.3389/fpsyg.2022.899730> PMID: 36248523
59. Card KG. Collectivism, individualism and COVID-19 prevention: a cross sectional study of personality, culture and behavior among Canadians. *Health Psychol Behav Med*. 2022;10(1):415–38. <https://doi.org/10.1080/21642850.2022.2069571> PMID: 35528715

60. Mehta JM, Chakrabarti C, De Leon J, Homan P, Skipton T, Sparkman R. Assessing the role of collectivism and individualism on COVID-19 beliefs and behaviors in the Southeastern United States. *PLoS One*. 2023;18(1):e0278929.
61. Gelfand MJ, Jackson JC, Pan X, Nau D, Pieper D, Denison E, et al. The relationship between cultural tightness-looseness and COVID-19 cases and deaths: a global analysis. *Lancet Planet Health*. 2021;5(3):e135–44. [https://doi.org/10.1016/S2542-5196\(20\)30301-6](https://doi.org/10.1016/S2542-5196(20)30301-6) PMID: 33524310
62. Ivic S. Vietnam's Response to the COVID-19 Outbreak. *Asian Bioeth Rev*. 2020;12(3):341–7. <https://doi.org/10.1007/s41649-020-00134-2> PMID: 32837558
63. Guidry JPD, O'Donnell NH, Austin LL, Coman IA, Adams J, Perrin PB. Stay Socially Distant and Wash Your Hands: Using the Health Belief Model to Determine Intent for COVID-19 Preventive Behaviors at the Beginning of the Pandemic. *Health Educ Behav*. 2021;48(4):424–33. <https://doi.org/10.1177/10901981211019920> PMID: 34185596
64. Clark AE, D'Ambrosio C, Onur I, Zhu R. COVID-19 compliance behaviors of older people: The role of cognitive and non-cognitive skills. *Econ Lett*. 2022;210:110158. <https://doi.org/10.1016/j.econlet.2021.110158> PMID: 34866717
65. Xiong A, Li Y, Liu S, Li H. Knowledge acquisition and precautionary behaviors for individual resilience to the COVID-19 pandemic: A study of rural Latin America. *J Rural Stud*. 2022;95:373–81. <https://doi.org/10.1016/j.jrurstud.2022.09.015> PMID: 36185827
66. Albert D, Chein J, Steinberg L. Peer influences on adolescent decision making. *Curr Dir Psychol Sci*. 2013;22(2):114–20.
67. Pelletier JE, Graham DJ, Laska MN. Social norms and dietary behaviors among young adults. *Am J Health Behav*. 2014;38(1):144–52. <https://doi.org/10.5993/AJHB.38.1.15> PMID: 24034689
68. Brookes G. Empowering People to Make Healthier Choices: A Critical Discourse Analysis of the Tackling Obesity Policy. *Qual Health Res*. 2021;31(12):2211–29. <https://doi.org/10.1177/10497323211027536> PMID: 34189976
69. Bottoni G. Validation of a social cohesion theoretical framework: a multiple group SEM strategy. *Quality & Quantity*. 2018;52(3):1081–102.
70. Gopichandran V, Subramaniam S, Kalsingh MJ. COVID-19 Pandemic: a Litmus Test of Trust in the Health System. *Asian Bioeth Rev*. 2020;12(2):213–21. <https://doi.org/10.1007/s41649-020-00122-6> PMID: 32837551
71. Vanhamel J, Meudec M, Van Landeghem E, Ronse M, Gryseels C, Reyniers T, et al. Understanding how communities respond to COVID-19: experiences from the Orthodox Jewish communities of Antwerp city. *Int J Equity Health*. 2021;20(1):78. <https://doi.org/10.1186/s12939-021-01417-2> PMID: 33722263
72. Vijaykumar S, Rogerson DT, Jin Y, de Oliveira Costa MS. Dynamics of social corrections to peers sharing COVID-19 misinformation on WhatsApp in Brazil. *J Am Med Inform Assoc*. 2021;29(1):33–42. <https://doi.org/10.1093/jamia/ocab219> PMID: 34672323
73. Borkowska M, Laurence J. Coming together or coming apart? Changes in social cohesion during the Covid-19 pandemic in England. *European Societies*. 2021;23(sup1):S618–36.
74. Laurence J, Kim HH-S. Individual and community social capital, mobility restrictions, and psychological distress during the COVID-19 pandemic: a multilevel analysis of a representative US survey. *Soc Sci Med*. 2021;287:114361. <https://doi.org/10.1016/j.socscimed.2021.114361> PMID: 34530221
75. Miao J, Zeng D, Shi Z. Can neighborhoods protect residents from mental distress during the COVID-19 pandemic? Evidence from Wuhan. *Chinese Sociological Review*. 2021;53(1):1–26.
76. Ransome Y, Ojikutu BO, Buchanan M, Johnston D, Kawachi I. Neighborhood Social Cohesion and Inequalities in COVID-19 Diagnosis Rates by Area-Level Black/African American Racial Composition. *J Urban Health*. 2021;98(2):222–32. <https://doi.org/10.1007/s11524-021-00532-3> PMID: 33759068
77. Pierce JB, Harrington K, McCabe ME, Petito LC, Kershaw KN, Pool LR, et al. Racial/ethnic minority and neighborhood disadvantage leads to disproportionate mortality burden and years of potential life lost due to COVID-19 in Chicago, Illinois. *Health Place*. 2021;68:102540. <https://doi.org/10.1016/j.healthplace.2021.102540> PMID: 33647635
78. Shiloh S, Peleg S, Nudelman G. Vaccination Against COVID-19: A Longitudinal Trans-Theoretical Study to Determine Factors that Predict Intentions and Behavior. *Ann Behav Med*. 2022;56(4):357–67. <https://doi.org/10.1093/abm/kaab101> PMID: 34864833
79. Kibi S, Shaholli D, Barletta VI, Vezza F, Gelardini M, Ardizzone C. Knowledge, Attitude, and Behavior toward COVID-19 Vaccination in Young Italians. *Vaccines (Basel)*. 2023;11(1).
80. Ruiz JB, Bell RA. Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey. *Vaccine*. 2021;39(7):1080–6.
81. Parker AM, Atshan S, Walsh MM, Gidengil CA, Vardavas R. Association of COVID-19 Vaccination With Influenza Vaccine History and Changes in Influenza Vaccination. *JAMA Netw Open*. 2022;5(11):e2241888. <https://doi.org/10.1001/jamanetworkopen.2022.41888> PMID: 36374504
82. Huynh HP, Zsila Á, Martinez-Berman L. Psychosocial Predictors of Intention to Vaccinate Against the Coronavirus (COVID-19). *Behav Med*. 2023;49(2):115–29. <https://doi.org/10.1080/08964289.2021.1990006> PMID: 34702134