The role of social capital on Covid-19 deaths

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Abstract

Background: Covid-19 pandemic shows a continuously increasing trend with a huge variation in the number of Covid-19 deaths across countries. In response, many countries have implemented non-pharmaceutical methods of intervention such as social distancing and lockdowns. This study aims to investigate the relationship between the four dimensions of social capital (community attachment, social trust, family bond, and security) with several control variables of Covid-19 deaths.

Methods: We retrieved data from open access databases and our survey data. Covid-19 deaths related data were collected from the website “Center for Systems Science and Engineering (CSSE) at Johns Hopkins University”. Social capital related data was collected from a large-scale survey of 100,956 respondents across 37 countries that including web-based and face-to-face surveys covering all regions/provinces/states of 37 countries in 2017. Data regarding population density, hospital beds numbers, and population age 65 or older, was retrieved from the World Development Indicators (WDI). Data on country lockdown was obtained from the website “National responses to the 2019-20 coronavirus pandemic”. Linear regressions were applied to identify the relationship between social capital and Covid-19 deaths.

Results: We found that Covid-19 deaths are associated with social capital both positively and negatively. Community attachment and social trust were associated with more Covid-19 deaths and family bond and security were associated with less deaths. Covid-19 deaths were positively associated with population density, aging population, and interactions between four dimensions of social capital.
related factors and aging population. Furthermore, number of hospital beds and early lockdown policy were negatively associated with Covid-19 deaths.

**Conclusions:** The results indicate that the role of social capital on dynamically evolving threats such as the current Covid-19 pandemic does not always negatively or positively. Therefore, countries require changes of behavior of people to response Covid-19 threat.

**Keywords:** Social capital; Covid-19; Deaths; Pandemic

**Background**

Since the first report of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in China, the Coronavirus disease 2019 (Covid-19) (1) spread as a pandemic affecting the whole world. More than 35 million people have been infected while more than 1 million deaths were reported by October 5, 2020. The Covid-19 pandemic shows a continuously increasing trend with a huge variation in the infections and deaths across countries. Compared with the other countries, most of the American and European countries experienced a large number of Covid-19 cases and deaths (2). In response to the rising numbers of cases and deaths, many countries have implemented non-pharmaceutical methods of interventions, such as social distancing, case isolation and quarantine, contact tracing, and lockdowns (3–7). Although many studies were conducted, we know little the ways of permanently controlling this pandemic and the reasons behind the variation in cases and deaths across countries. This kind of differences implicit that not only clinical characteristics but also other social contextual factors such as social capital determine Covid-19 deaths.

The concept of social capital was initially defined by sociologists in the 1980s as the aggregated value of connections between individuals and the norms of mutuality developed from the network (8). Several definitions of social capital have been advanced, most of them included similar concepts. Social capital is the commonly identified traits of social organization, such as trust between individuals, standards of correspondence and interpersonal connections that could increase the efficiency of society creating platforms which could be beneficial to many parties (9). We turned to
the previous studies on social capital and health outcomes to make sense of emerging relationships between social capital and Covid-19 deaths (10–17). Although most of social capital and health studies have provided the positive side of social capital (10–12,17), studies related to negative side of social capital on health have been growing (14–16). Therefore, the relationship between social capital and health is a double-edged phenomenon (16). An important problem that needs to be addressed is the connection between social capital and the prevalence of Covid-19 related deaths, based on existing studies on the relationship between social capital and health.

In the pandemic context, some clinical studies have shown that Covid-19 mortality can occur due to by age, smoking, obesity, lack of immunity, hospital care, and it also can be commonly observed among patients with some other diseases such as diabetes and heart diseases (18–21). However, only these clinical evidences are insufficient to propel the implementation of policies to reduce the number of Covid-19 related deaths. However, certain studies related to social capital have attempted to fill the gap left by the lack of research on Covid-19. Several studies have concluded that the development and the maintenance of different types of social ties leads to response Covid-19 pandemic (22). A recent study has analyzed the positive association for Covid-19 deaths with social trust (23). However, the results of previous studies related to Covid-19 have not shown a similar conclusion on social capital and Covid-19 related deaths.

This study aims to investigate the relationship between social capital related factors which are community attachment, social trust, family bond, and security with several control variables on Covid-19 deaths, hypothesizing Covid-19 deaths can be explained more through social capital. Social capital can be measured by different dimensions and in this study, the four factors of community attachment (24,25), social trust (24,26–28), family bond (29,30), and security (29,31,32) were used to measure social capital based on some previous studies. Moreover, we assume that rely on both prior pandemic and health studies of positive relationship between social capital and health (32–34), all these four factors may associate negatively on Covid-19 related deaths. Linear regression analyses were
performed, and eight different linear regression models were regressed with social capital related factors and by adding other explanatory variables one by one (Table 2). We analyzed data on Covid-19 deaths in 37 countries until 5 October 2020. We examined how social capital associate with Covid-19 deaths as well as association of social capital with aged population on Covid-19 deaths. Finally, this study analyzed the relationship of Covid-19 deaths with population density, aged population, number of hospital beds, and country lockdown, as a proxy for governments’ policy.

Methods

Study design and data sources

For this study, we used data from open access databases and our survey data. We collected Covid-19 related data from the website “COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University” (2). This website has complied data from several important sources, such as the World Health Organization (WHO), European Centre for Disease Prevention and Control (ECDC), and WorldoMeters which had documented Covid-19 case numbers, death numbers, recovered numbers, active case numbers, testing rate, case-fatality ratio and incidence rate from 188 countries by country, provinces/states. We identified 35,157,350 Covid-19 cases with 1,037,075 deaths at 11.00 AM on October 05, 2020 from the CSSE database.

Social capital data was collected from a large-scale survey of 100,956 respondents across 37 countries that including web-based and face-to-face surveys covering all regions/provinces/states of 37 countries in 2017. Data regarding population density, hospital beds numbers, and population age 65 or older, was retrieved from the World Development Indicators (WDI) (35). Data on country lockdown was obtained from the website “National responses to the 2019-20 coronavirus pandemic” (36).

The most recent year for WDI country data was available in 2018. After merging our survey data with Covid-19 data and WDI country- level data, the study sample consisted of totally 765,875 deaths in 37 countries. Among 37 countries, 8 countries which are China, India, USA, Indonesia, Brazil, Russia, Mexico, and Japan were separated into provinces/states due to highest population countries in the
sample. Therefore, total number of observations was 294. The sample countries and cumulative Covid-19 deaths are described in Supplementary Table S1.

**Measures**

Covid-19 death was measured as number of deaths per square kilometre (km²). The deaths per km² were calculated by dividing the number of deaths by the land area km² of 29 countries and land area km² of provinces of 8 largest population countries.

The social capital was measured by four factors which were constructed from previous studies in different dimensions. For instance, community attachment, social trust, family bond, and security. Therefore, those four factors were used to measure social capital in this study. All those four variables are dummy variables and community attachment, social trust, and security were measured by Likert scale whereas family bond was measured as binary dummy variable. Then, the average values of all four variables for 29 countries and for 8 countries by provinces, were calculated. The questions for measure to social capital related factors are described in Supplementary Table S2 and the survey questionnaire provided in Supplementary Material 2.

Rest of other explanatory variables are population density, population age 65 or older, interactions terms between population age 65 or older and social capital related factors. Number of hospital beds, and country lockdown. Population density was measured by dividing total population of each country by land area km² of 29 countries and land area km² of provinces of 8 largest population countries. Population aged 65 or older was measured by dividing total population of each country by land area km² of 29 countries and total population of provinces of 8 highest population countries. The number of beds was measured per 1,000 people. Country lockdown was a dummy variable and it was measured by the number of days that were spent to take the decision to shut down/lockdown or imposed stay at home order of considered countries after report the first covid-19 case in China. If a country was locked down or imposed stay at home order after 50 days, it was called an early lockdown, if it was locked down after 100 days, it was called a late lockdown and if a country was not locked down, it
was referred to as no lockdown. We used all the variables in log-form except number of beds and country lockdown to make the data conform more closely to the normal distribution and to improve the model fit.

**Multiple regression analyses**

First, we investigated the correlation between Covid-19 deaths per km² and four factors which used to measure social capital, because the social capital is the main explanatory predictor than other predictors in our model. In the multiple regression analyses, Covid-19 deaths per km² is the dependent variable and the main explanatory variable is social capital. Therefore, we regressed eight different linear regression models with social capital related variables and the other explanatory variables were added one by one. All analyses were performed using the Stata 16 software.

**Results**

**Descriptive statistics**

**Table 1** Descriptive statistics of model variables

| Variables                                    | N  | Mean  | SE   | 95% CI         |
|----------------------------------------------|----|-------|------|----------------|
| Death per km²                                | 293| 0.09  | 0.029| 0.03-0.14      |
| **Social Capital related factors**           |    |       |      |                |
| Community attachment a                       | 293| 3.71  | 0.03 | 3.65-3.77      |
| Social trust b                               | 293| 4.53  | 0.01 | 4.52-4.57      |
| Family bond c                                | 293| 0.90  | 0.01 | 0.88-0.93      |
| Security d                                   | 293| 2.95  | 0.02 | 2.91-2.98      |
| **Other explanatory variables**              |    |       |      |                |
| Population density                          | 293| 466.78| 83.53| 302.37-631.19 |
| Population aged 65 or older per km²         | 293| 42.77 | 8.67 | 25.69-59.84   |
| Community attachment*Population aged 65 or older per km² (Aged65CA) | 291| 2.79  | 0.15 | 2.48-3.09     |
| Social trust*Population aged 65 or older per km² (Aged65ST) | 291| 3.00  | 0.15 | 2.69-3.31     |
| Family bond*Population aged 65 or older per km² (Aged65FB) | 290| 1.34  | 0.16 | 1.03-1.66     |
| Security*Population aged 65 or older per km² (Aged65S) | 291| 2.56  | 0.15 | 2.26-2.87     |
| Bed number per 1,000 people                  | 293| 4.28  | 0.25 | 3.79-4.77     |
| Country lockdown e                           | 293| 2.04  | 0.06 | 1.93-2.16     |

*Note:* a,b,d Range of data: from 1 to 5. c Range of data: from 0 to 1. e Range of data: from 1 to 3.
Table 1 summarizes the Covid-19 deaths per km² and regression covariates. For the 294 observations (29 countries and 264 provinces of 8 countries), the mean Covid-19 deaths per km² was 0.09 (95% CI 0.03 to 0.14). The mean community attachment was 3.71 (95% CI 3.65 to 3.77); the mean social trust was 4.53 (95% CI 4.52 to 4.57); the mean family bond was 0.90 (95% CI 0.88 to 0.93); and the mean security was 2.95 (95% CI 2.91-2.98). Furthermore, the mean population density was 466.78 (95% CI 302.37 to 631.19); the mean population aged 65 or older per km² was 42.77 (95% CI 25.69 to 59.84); the mean population aged 65 or older with community attachment was 2.79 (95% CI 2.48 to 3.09); the mean population aged 65 or older with social trust was 3.00 (95% CI 2.69 to 3.31); the mean population aged 65 or older with family bond was 1.34 (95% CI 1.03 to 1.66) the mean population aged 65 or older with security was 2.56 (95% CI 2.26 to 2.87); the mean bed number per 1,000 people was 4.28 (95% CI 3.79 to 4.77), and the mean country lockdown policy was 2.04 (95% CI 1.93 to 2.16).

Simple regression analyses: relationships between Covid-19 deaths per km² and social capital
Relationships between Covid-19 deaths per km² and social capital related factors are illustrated in Fig. 1. Figure 1a, and 1b demonstrates that Covid-19 deaths per km² was positively and significantly associated with community attachment for all countries (r = 0.27, P = 0.000) and provinces of 8 countries (r = 0.24, P = 0.000). Figure 1c and 1d also displays that the positive correlation between Covid-19 deaths per km² and social trust was significant for all countries (r = 0.29, P = 0.000) and provinces of 8 countries (r = 0.32, P = 0.000). In contrast, Figure 1e and 1f exhibits that the negative and significant correlation between Covid-19 deaths per km² and family bond for all countries (r = 0.15, P = 0.014) and provinces of 8 countries (r = 0.21, P = 0.001). Finally, Figure 1g and 1h reveals that the negative correlation between Covid-19 deaths per km² and security for all countries (r = 0.07, P = 0.231) and provinces of 8 countries (r = 0.06, P = 0.307).
a. All countries and provinces/states

\[ r = 0.27 \]
\[ p = 0.000 \]

b. Provinces/states of 8 countries

\[ r = 0.24 \]
\[ p = 0.000 \]

c. All countries and provinces/states

\[ r = 0.29 \]
\[ p = 0.000 \]

d. Provinces/states of 8 countries

\[ r = 0.32 \]
\[ p = 0.000 \]

e. All countries and provinces/states

\[ r = -0.15 \]
\[ p = 0.014 \]

f. Provinces/states of 8 countries

\[ r = -0.21 \]
\[ p = 0.001 \]

g. All countries and provinces/states

\[ r = -0.07 \]
\[ p = 0.231 \]

h. Provinces/states of 8 countries

\[ r = -0.06 \]
\[ p = 0.307 \]
**Figure 1.** Correlation between Covid-19 deaths per km\(^2\) and social capital related factors. Sample was categorized by two groups such as a, c, e and g were considered 29 countries and 8 largest population countries by provinces/states together (N=294) and b, d, f and h were considered only 8 largest population countries by provinces/states (N=265). Red lines are linear predictions of Covid-19 deaths per km\(^2\) on each factor of social capital. The 95% confidence intervals of the fitted values are shown by gray areas (r: correlation coefficient, p: probability value).

**Multiple regression analyses**

Results of multiple regressions for predicting Covid-19 deaths per km\(^2\) are shown in Table 2. According to our aim, we included the social capital related factors for all specifications (1-8) to check robustness of the predictions of social capital related factors. In column 1-7, we included one by one other explanatory variables with social capital related factors. In column 3-6, we included social capital related factors with population aged 65 or older as interaction terms. In column 8, we included all of explanatory variables simultaneously in the regression model.
### Table 2 Multiple regressions result for Covid-19 deaths

| Variables                        | 1             | 2             | 3             | 4             | 5             | 6             | 7             | 8             |
|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Intercept                        | -41.974***    | -33.473***    | -33.473***    | -33.473***    | -33.473***    | -33.473***    | -19.645***    | -21.416***    |
|                                  | (6.606)       | (6.216)       | (3.552)       | (6.216)       | (6.215)       | (6.216)       | (5.431)       | (4.623)       |
| Log (Community attachment)       | 3.767***      | 4.862***      | 4.181***      | 4.862***      | 4.862***      | 4.862***      | 3.581***      | 2.273***      |
|                                  | (1.139)       | (1.019)       | (1.026)       | (1.019)       | (1.019)       | (1.019)       | (1.188)       | (0.997)       |
| Log (Social trust)               | 21.000***     | 15.859***     | 15.178***     | 15.859***     | 15.859***     | 15.859***     | 8.285**       | 10.769***     |
|                                  | (4.216)       | (3.869)       | (3.855)       | (3.869)       | (3.869)       | (3.869)       | (3.351)       | (2.831)       |
| Log (Family bond)                | -0.858***     | -1.485***     | -1.485***     | -1.485***     | -2.166***     | -1.485***     | -0.570*       | -0.345*       |
|                                  | (0.308)       | (0.326)       | (0.326)       | (0.326)       | (0.329)       | (0.326)       | (0.342)       | (0.191)       |
| Log (Security)                   | -2.983***     | -3.384***     | -3.384***     | -3.384***     | -3.384***     | -4.065***     | -3.586***     | -5.096***     |
|                                  | (0.961)       | (0.882)       | (1.035)       | (0.882)       | (0.882)       | (0.882)       | (1.096)       | (0.849)       |
| Log (population density)         | 0.623***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      |
|                                  | (0.075)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       |
| Log (Aged65 or older)            | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      |
|                                  | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       |
| Log (Aged65CA)                   | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      |
|                                  | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       |
| Log (Aged65ST)                   | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      |
|                                  | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       |
| Log (Aged65FB)                   | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      | 0.681***      |
|                                  | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       | (0.049)       |
| Bed number per 1,000 people      | -0.013        | -0.013        | -0.013        | -0.013        | -0.013        | -0.013        | -0.228**      | -0.228**      |
|                                  | (0.752)       | (0.752)       | (0.752)       | (0.752)       | (0.752)       | (0.752)       | (0.036)       | (0.036)       |
| Country lockdown                 |               |               |               |               |               |               |               |               |
| 2 Early lockdowns                | -3.843***     | -1.241        | -3.843***     | -1.241        | -3.843***     | -1.241        | -3.843***     | -1.241        |
|                                  | (0.583)       | (0.763)       | (0.583)       | (0.763)       | (0.583)       | (0.763)       | (0.583)       | (0.763)       |
| 3 Late lockdowns                 | 1.712***      | 0.947***      | 1.712***      | 0.947***      | 1.712***      | 0.947***      | 1.712***      | 0.947***      |
|                                  | (0.331)       | (0.259)       | (0.331)       | (0.259)       | (0.331)       | (0.259)       | (0.331)       | (0.259)       |
| R²                               | 0.29          | 0.52          | 0.52          | 0.52          | 0.52          | 0.52          | 0.37          | 0.67          |
| Adj. R²                          | 0.28          | 0.51          | 0.51          | 0.51          | 0.51          | 0.51          | 0.36          | 0.66          |
| N                                | 278           | 276           | 276           | 276           | 276           | 276           | 278           | 277           |

*Note:* The dependent variable was Covid-19 deaths per km² (log). Robust standard error in parentheses. ****, ***, and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Among the social capital related factors, two factors which are community attachment and social trust were associated with more Covid-19 deaths per km². In contrast, two other factors which are family bond and security were associated with less Covid-19 deaths per km² in all specifications. Other explanatory variables, population density and population aged 65 or older per km² were associated to increase Covid-19 deaths per km²; social capital related factors with population aged 65 or older were associated to increase Covid-19 deaths per km². One additional bed per 1,000 people was associated to
reduce Covid-19 deaths per km$^2$. Although no lockdown policy was associated to reduce Covid-19 deaths, early lockdown policy was associated to reduce Covid-19 deaths more than no lockdown policy and also late lockdown policy was associated to reduce Covid-19 deaths less than no lockdown policy.

**Robustness analyses**

As robustness checks, although we included other explanatory variables with social capital related factors in several multiple regressions, main results did not change. Furthermore, robust standard error implies that no heteroscedasticity and diagnostic tests confirmed that normality and no multicollinearity in the regressions. In addition, we tested the correlation between Covid-19 deaths per km$^2$ and social capital related factors by 8 highest population countries separately which are included in our sample. Most of the results were similar to Figure 1 results. The results are presented in Supplementary Figure S1.

**Discussion**

To the best of our knowledge, this is the first systematical study to examine the social capital impact on Covid-19 deaths. The multiple regressions revealed that Covid-19 deaths are associated with social capital related factors in two dimensions. As we hypothesized, Covid-19 deaths can be explained by social capital whereas it shows in two dimensions. The community attachment and social trust were associated to increase Covid-19 deaths. Two other factors which are family bond and security were associated to reduce Covid-19 deaths in this study. The key findings of the study are discussed below.

In this study, we found that a percentage point increase in average community attachment and social trust are associated with a 4% and a 14% (on average) increase in Covid-19 deaths respectively. In contrast, a percentage point increase in average family bond and security are associated with a 1% and a 4% (on average) reduce in Covid-19 deaths respectively. Therefore, positive impact of social capital related factors was larger than negative impact on Covid-19 deaths in all specifications. Especially, in
terms of correlation coefficients indicated that the similar conclusions of social capital related factors with Covid-19 deaths by country level as well as provinces of 8 countries (Figure 1). Although we expected to find negative associations according to prior evidence of positive link between social capital and health (e.g., 11–13,17), community attachment and social trust were positively associated on Covid-19 deaths. These findings consistent with, less institutional trust of people interferes with endeavors to contain transmission through physical distancing (37), and high social trust societies might be more vulnerable to deception about the severity of Covid-19, counterfeit treatments, and contemptuous perspectives towards physical distancing (38). In addition, family bond and security were negatively associated on Covid-19 deaths. These findings align with studies that found family social capital has several dimensions and its components show clear relationship with health (30) and neighborhood social capital is influenced to health communication (31,32,39). These results suggest that social capital has double-edged phenomenon (16). It implies that social capital does not always positively or negatively effect on health (23).

Population density was found in this study to be associated with more Covid-19 deaths per km². This finding consists with population density associate with Covid-19 outbreak and related deaths (40–42). Recent clinical studies have discussed that old age people have high Covid-19 mortality risk (e.g., 18,20,21). Our study also confirmed that a high population aged 65 or older significantly associated high Covid-19 deaths. In addition, interaction terms of social capital related factors with aged 65 or older population appeared to have more deaths of Covid-19. The number of hospital beds was negatively and significantly associated with Covid-19 deaths. This finding implies that hospital bed is a critical input in treating Covid-19 infected patients (43). In addition, country lockdown as a dummy variable which appeared early lockdown was a more effective response to reduce Covid-19 deaths than no lockdown and late lockdown policies (7,44).
There are some limitations in this study. Firstly, this study included only 37 countries based on our survey data. However, countries including USA, India, Brazil, Russia, and Spain which reported the highest Covid-19 infections and deaths were included in our sample. Secondly, we selected only a limited number of factors that potentially determine the Covid-19 deaths in a country. In order to improve the prediction accuracy, other factors also may be included in studies conducted in the future. Finally, although Covid-19 data were available by country level as well as provinces level, there was a lack of public data for other demographic variable in certain countries. However, the results of this study can still contribute to future pandemic-related policymaking at the country level.

Conclusions

In response to the rising numbers of Covid-19 cases and deaths, most of countries have implemented methods of interventions to control this pandemic in country-level until a vaccine is developed. It is important to identify social contextual factors that situate with the health impacts of the Covid-19 pandemic supports public health policy.

In summary, our analysis found that social capital related factors were associated in two dimensions with Covid-19 deaths. Moreover, community attachment and social trust were associated with more Covid-19 related deaths whereas family bond and security were associated with less Covid-19 related deaths. In addition, higher Covid-19 deaths are associated with higher population density, aging population, fewer hospital beds, and lower government effectiveness. However, social capital related factors show that both positive and negative effect on Covid-19 deaths, showing a dynamic role of social capital. It implies that social capital does not always positively or negatively affect health. From this analysis, we conclude social determinants of health are affected significantly to dynamically evolving threats such as the current Covid-19 pandemic. Therefore, countries require changes of behavior of people to response Covid-19 threat.
Abbreviations

**Covid-19**: Coronavirus disease 2019

**SARS-CoV-2**: Severe Acute Respiratory Syndrome Coronavirus 2

**CSSE**: Center for Systems Science and Engineering

**WHO**: World Health Organization

**ECDC**: European Centre for Disease Prevention and Control

**WDI**: World Development Indicators

**Declarations**

**Ethic approval and consent to participate**

The undisclosed review committee for Kyushu University, Japan reviewed and provided ethical approval for this research. All procedures performed in this study were in accordance with the ethical standards. The survey was used both web-based and face-to-face surveys methods. At the beginning of each interview and web-survey, respondents were informed about the purpose of the survey and their right to voluntarily participate. All participants provided informed consent prior to response the questionnaire.

**Consent for publication**

Not applicable

**Availability of data and materials**

This study is used both open access data and survey data. For Covid-19 deaths related data, we used the dataset maintained by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University: https://coronavirus.jhu.edu/map.html. Data regarding population density, hospital beds numbers, and population age 65 or older, was retrieved from the World Development Indicators: https://datatopics.worldbank.org/world-development-indicators/. Data on country lockdown was obtained from the website “National responses to the 2019-20 coronavirus pandemic”: 
https://en.wikipedia.org/wiki/National_responses_to_the_COVID-19_pandemic. Social capital data was collected from a large-scale survey of 100,956 respondents across 37 countries that including web-based and face-to-face surveys covering all regions/provinces/states of 37 countries in 2017. Survey data is available from the corresponding author on reasonable request.

**Competing interest**
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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**Author contribution**
JIA conducted analysis, wrote manuscript and produced tables and figures. SM formulated the research idea and supervision. All authors read and approved the final manuscript.

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