Individual-level social capital and COVID-19 vaccine hesitancy in Japan: a cross-sectional study

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ABSTRACT
To reduce vaccine hesitancy, it is important to identify factors that can intervene at the individual or community level. Social capital is a possible factor because it is associated with various vaccine hesitancy, such as for measles and influenza. However, limited studies have explored the association between social capital and vaccination for COVID-19, which is an unprecedented pandemic and infodemic. Therefore, this study aimed to clarify the association between social capital and COVID-19 vaccination during the pandemic. This cross-sectional study used quota sampling for an online-based survey. Participants were asked whether they had previously been vaccinated for COVID-19 and their intention to receive a COVID-19 vaccine booster. Social capital was evaluated using three measures (individual-level civic participation, social cohesion, and reciprocity). Multiple logistic regression analysis was performed to clarify the association between social capital and previous COVID-19 vaccination status as well as intention to receive a COVID-19 booster. Participants were 2,313 individuals, of whom 87.2% had received a COVID-19 vaccine; 72.3% intended to obtain a COVID-19 booster. Individuals with any social capital are more likely to receive a COVID-19 vaccination than those with none (OR: 1.73, 95% CI: 1.18–2.54; OR: 1.58, 95% CI: 1.22–2.05; OR: 3.05, 95% CI: 2.15–4.33). These indicators were also associated with the intention to receive a COVID-19 booster. Thus, our results suggest that among the general public, those with individual-level social capital are more likely to receive a COVID-19 vaccination than those with none. Social capital may be a factor that can reduce vaccine hesitancy during a pandemic.

Introduction
The coronavirus disease 2019 (COVID-19) poses a public health threat.1 Vaccination is a key strategy for mitigating the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and thereby reducing the number of COVID-19 cases and related mortality.2–5 However, vaccine hesitancy, particularly for COVID-19 vaccines, has become a major public health concern.6–8 Vaccine hesitancy is defined as "delay in acceptance or refusal of vaccination despite availability of vaccination services."9 The development and production of the COVID-19 vaccines during the pandemic were carried out at an unprecedented speed, as various initiatives were implemented.10–12 This rapid development of such vaccines has led to safety concerns and mistrust in government among the general population. This resulted in low vaccination intention among citizens in many countries even before the vaccines were distributed.6–8–13 Moreover, some people have a low perception of risk of infection and severity for COVID-19, which has led to vaccine hesitancy.14–15

Additionally, the infodemic has also emerged as a serious problem associated with this pandemic and COVID-19 vaccines, causing misinformation to spread rapidly through social media platforms and other outlets.16,17 The most widely used COVID-19 vaccines worldwide are messenger RNA (mRNA) vaccines such as the BNT162b2 and mRNA-1273, a type of vaccine that is new to the general public.18,19 Due to the novel nature of COVID-19 vaccines, misinformation and conspiracy theories have disseminated worldwide during the pandemic.20,21 Given the above points, the circumstances surrounding COVID-19 vaccine hesitancy and factors that influence it, may be different from other vaccines. In Japan, two types of mRNA vaccines, the BNT162b2 and mRNA-1273, have been mainly incorporated into the national immunization program as of 2021. But the dimensions of COVID-19 pandemic and its vaccine hesitancy are not comparable to those of other vaccine-preventable diseases.22

Despite facing various problems, COVID-19 vaccination programs have been launched and implemented with full force in many countries, leaving very little time to consider necessary measures to improve vaccination intention among
the general population. To reduce hesitancy toward vaccines developed during a pandemic, it is important to identify factors that can be used as intervention points at the individual or community level at the beginning of a vaccine program or even before a pandemic occurs. One such factor may be social capital. Social capital is defined as “resources that are accessed by individuals as a result of their membership of a network or group.” Social capital, which includes individual-level and community-level social capital, has been widely used to understand the social determinants of health. Some previous studies on vaccines for measles, pandemic influenza, and pneumococcal diseases, have reported that community-level social capital reduced an individual’s vaccine hesitancy. Additionally, many previous studies have reported that individual-level social capital reduces vaccine hesitancy for various vaccines, such as measles, pandemic influenza vaccine, seasonal influenza vaccine, and pneumococcal diseases. It is thought that individual-level social capital and community-level social capital affect health outcomes through various pathways, where individual-level social capital influences health outcomes through the acquisition of useful information, the receipt of instrumental support, and social reinforcement. Therefore, it may be possible that individual-level social capital could improve the acquisition of correct information about COVID-19, its vaccines, and support for vaccination, which could result in reduced vaccine hesitancy, even in a pandemic or infodemic. However, limited studies have investigated the association between social capital and COVID-19 vaccine hesitancy. Thus, the aim of this study was to clarify the association between individual-level social capital and previous COVID-19 vaccination status, and the intention to receive a vaccine booster during the pandemic.

Patients and methods

Study sample and data collection

This cross-sectional study used fourth-wave survey data from a longitudinal study, which was initially conducted to examine the implementation of personal protective measures among the general Japanese population during the COVID-19 pandemic. Participants in the study were recruited from among the registrants of a Japanese Internet research service company called MyVoice Communication, Inc. In the first-wave survey of the study, conducted in January 2021, we aimed to collect data from 3,000 men and women, aged 20–79 years, from all regions of Japan. Quota sampling based on age, sex, and residential area was used. We stratified the 3,000 participants according to sex, age (five-year age groups), and residential area (i.e., Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku, and Kyushu regions), and set a target number of respondents for each group. Details of the longitudinal study are reported elsewhere. The company reached out to the 3,000 potential participants who participated in the first-wave survey, by e-mail, requesting their participation in the fourth-wave survey on 21 January 2022. Reward points, valued at 20 yen (approximately 0.17 US dollars as of January 2022), were provided as incentive for participation. This study was approved by the Ethics Committee of Tokyo Medical University, Tokyo, Japan (No: T2019–0234). Informed consent was obtained from all respondents.

Assessment of COVID-19 vaccination

In this study, we measured the previous status of COVID-19 vaccination and intention to receive a COVID-19 vaccine booster as indicators of vaccine hesitancy. The main outcome was the previous status of COVID-19 vaccination. We asked participants the following yes/no question: “Have you received the COVID-19 vaccine?” The assessment of previously vaccinated individuals using self-reported questionnaires is considered a valid method.

Additionally, at the time of this survey, administration of the COVID-19 vaccine booster for healthcare workers and high-risk older individuals in Japan had begun, although it was not yet available to the general public. We also evaluated participants’ intention to receive a COVID-19 vaccine booster. We asked participants to indicate how likely they were to receive a COVID-19 vaccine booster. Five response options were provided: “very unlikely,” “moderately unlikely,” “neither,” “moderately likely,” and “very likely.” Responses of “very likely” or “moderately likely” were defined as having a high intention to receive a COVID-19 vaccine booster.

Assessment of individual-level social capital

In this study, civic participation, social cohesion, and reciprocity were evaluated as indicators of individual-level social capital. The survey items and criteria for each defined measure were those used in a previous study that reported an association between social capital and pneumococcal vaccination. These survey items were developed and validated by the Japan Gerontological Evaluation Study, to describe the health status and social determinants of physically and cognitively independent people. Individual-level civic participation was assessed, based on the frequency of participation among any of the following social groups: volunteer groups, sports groups/clubs, hobby activity groups, study/cultural groups, and groups that conduct activities to teach and share skills and experiences. We defined “any participation” as engaging in any of the social groups once a month or more, and “no participation” as participating in these social groups less than once a month. Individual-level social cohesion was assessed using the following questions: “Do you think people living in your area can be trusted in general?” “Do you think people living in your area often help others?”, and “What is your level of attachment to the area where you currently live?”. We defined “presence of social cohesion” to be when participants responded with “very much” or “moderately” to at least one of the three questions and “absence of social cohesion” to be when participants responded with “neither,” “not much,” or “not at all” to all questions. Individual-level reciprocity was assessed using the following questions: “Do you have someone to talk about your concerns and complaints?”, “Do you listen to someone’s concerns and complaints?”, and “Do you have someone who can take care of you when you are sick and in
bed for a few days?”. We defined “presence of any support” to be when participants responded with “any one or more” to any of the questions and “lack of support” to be when participants responded “no one” to all three questions.28

**Assessment of covariates**

Participants reported their sex, age, underlying diseases (including heart disease, respiratory disease, kidney disease, cancer, diabetes, and hypertension [yes or no]), marital status (married or unmarried), employment status (employed or unemployed), residential area (47 prefectures), and living arrangements (living alone or with others).

The research company provided categorized data on educational attainment (university graduate or above/below) and annual household income level (<3 million yen [approximately 26,000 USD], 3 to <5 million yen [26,000 to <44,000 USD], 5 to <7 million yen [44,000 to <61,000 USD], and ≥7 million yen [≥61,000 USD]).

**Statistical analysis**

Characteristics of participants who had previously been vaccinated for COVID-19 and those who had not been vaccinated, were compared using a chi-square test. Similarly, characteristics of participants who have high intention of receiving a COVID-19 vaccine booster and those who do not, were also compared using a chi-square test. Multiple logistic regression analysis was performed to estimate the association between each social capital measure and previous COVID-19 vaccination status. The dependent variable was set as a dichotomous variable, coded as “1” if the participant had previously been vaccinated for COVID-19 and “0” otherwise. Model 1 was unadjusted. Model 2 was adjusted for the covariates (sex, age [20–49, 50–64, 65–79 years], underlying diseases, marital status, employment status, residential area [Tokyo metropolitan area/other areas], living arrangements, educational attainment, and annual household income). Additionally, the same analysis was performed with the independent variable being the intention to receive a COVID-19 booster shot. Statistical analyses were performed using IBM SPSS Statistics for Windows, version 28 (IBM Japan, Tokyo, Japan). Two-sided p-values <0.05 were considered to indicate statistical significance.

**Results**

Of the 3,000 potential participants, 2,389 participants responded in the fourth survey (response rate: 79.6%). We excluded 76 participants due to incomplete data provided by the survey company. The final sample included 2,313 participants.

Participant characteristics are presented in Table 1. Of the total participants, 87.2% had received the COVID-19 vaccine, and 72.3% intended to receive a COVID-19 vaccine booster. A higher percentage of participants who had individual-level civic participation, social cohesion, or reciprocity, received COVID-19 vaccination compared to those with no social capital. Among the covariates, a lower percentage of participants aged 20–39 years, with no underlying diseases, who were unmarried, who had a low educational level, and who had a low annual household income, were vaccinated compared to those in other categories. Similar trends were observed when comparing the characteristics of participants who did and did not intend to receive a COVID-19 vaccine booster (Table 2).

Table 3 shows the results of the logistic regression analysis of social capital and previous COVID-19 vaccination status. Having any participation, social cohesion, or support was significantly associated with higher odds of COVID-19 vaccination compared to the absence of these social capital indicators (individual-level civic participation: odds ratio [OR]: 1.73, 95% confidence interval [95% CI]: 1.18–2.54; individual-level social cohesion: OR: 1.58, 95% CI: 1.22–2.05; individual-level reciprocity: OR: 3.05, 95% CI: 2.15–4.33). These social capital measures were also associated with the intention to receive a COVID-19 vaccine booster (Table 4, OR: 1.61, 95% CI: 1.23–2.10; OR: 1.80, 95% CI: 1.47–2.21, OR: 2.24, 95% CI: 1.64–3.05).

**Discussion**

In this study, we aimed to clarify the association between individual-level social capital, evaluated by civic participation, social cohesion, and reciprocity, and COVID-19 vaccination hesitancy. We found that individual-level social capital was positively associated with previous status of COVID-19 vaccination and intention to receive a COVID-19 booster shot, whichever indicator be used for measurement. This study provides novel evidence of the association between social capital and vaccine hesitancy regarding the newly introduced mRNA COVID-19 vaccine among the general public during the pandemic.

Previous studies on vaccines for measles and seasonal influenza have reported that individual-level social capital reduced an individual’s vaccine hesitancy.27,33 A previous study, which used the same measurement for individual-level social capital as this study, also reported that it reduced an individual’s vaccine hesitancy toward pneumococcal diseases.28 Further, studies of pandemic influenza vaccines have reported that individual-level social capital is associated with vaccination rates and the intention to receive the vaccine, among adults and children.29–31 Regarding COVID-19 vaccine, ecological studies in the United States found a positive association between social capital and COVID-19 vaccination rate per state.34,35 Our results are consistent with those of previous studies and provide further evidence to suggest that individual-level social capital is also associated with hesitancy in relation to the mRNA COVID-19 vaccine during the pandemic. In other words, the presence of individual-level social capital may reduce COVID-19 vaccine hesitancy, even in a pandemic or infodemic.

There may be several pathways whereby social capital reduces vaccine hesitancy. Vaccine hesitancy is primarily influenced by three physiological factors (commonly referred to as the 3Cs model), complacency, convenience, and confidence,9 which may be improved by social capital. Individual-level social capital, measured by civic participation, social cohesion, and reciprocity in this study, helps individuals obtain useful
Table 1. Participants’ characteristics.

|                     | COVID-19 vaccination history |               |               |               |               |
|---------------------|------------------------------|---------------|---------------|---------------|---------------|
|                     | No                           | Yes           |               |               |               |
|                     | n=                           | n=296         | n=2017        |               |               |
|                     | n (%)                        | n (%)         | p-value*      |               |               |
| **Social capital**  |                              |               |               |               |               |
| Civic participation | No participation             | 1780          | 12.8%         |               |               |
|                     | Any participation             | 533           | 78.7%         |               |               |
| Social cohesion     | No cohesion                  | 760           | 66.2%         |               |               |
|                     | Any cohesion                 | 1553          | 1398          | <.001         |               |
| Reciprocity         | No support                   | 226           | 153           | <.001         |               |
|                     | Any support                  | 2087          | 1864          |               |               |
| **Other covariates**| Sex                          |               |               |               |               |
|                     | Men                          | 1154          | 1103          | 4.06          |               |
|                     | Age (years)                  |               |               |               |               |
|                     | 20–39                        | 573           | 467           | <.001         |               |
|                     | 40–64                        | 1108          | 950           |               |               |
|                     | 65–79                        | 632           | 600           |               |               |
| Underlying diseases  | No                           | 1586          | 1350          | <.001         |               |
|                     | Yes                          | 727           | 667           |               |               |
| Marital status      | Unmarried                    | 920           | 737           | <.001         |               |
|                     | Married                      | 1393          | 1280          |               |               |
| Employment status   | Unemployed                   | 899           | 783           | .903          |               |
|                     | Employed                     | 1414          | 1234          |               |               |
| Residential area    | Tokyo metropolitan area a    | 725           | 633           | 0.917         |               |
|                     | Other                        | 1588          | 1384          |               |               |
| Living arrangements | Living alone                 | 394           | 336           | .210          |               |
|                     | Living with others           | 1919          | 1681          |               |               |
| Educational level   | Below university graduate    | 1096          | 933           | .005          |               |
|                     | University graduate or above | 1217          | 1084          |               |               |
| Annual household income | <3 million yen (approximately 26,000 USD) | 510          | 422           | .008          |               |
|                     | 3 to < 5 million yen [26,000 to <44,000 USD] | 637          | 564           |               |               |
|                     | 5 to < 7 million yen [44,000 to <61,000 USD] | 495          | 439           |               |               |
|                     | ≥7 million yen or more       | 671           | 592           |               |               |

*p-value was calculated using a chi-square test.

Table 2. Comparison of participants’ characteristics among those with and without intention to receive a COVID-19 vaccine booster.

|                     | Intention to receive a COVID-19 vaccine booster |               |               |               |               |
|---------------------|------------------------------------------------|---------------|---------------|---------------|---------------|
|                     | No                           | Yes           |               |               |               |
|                     | n=                           | n=641         | n=1672        |               |               |
|                     | n (%)                        | n (%)         | p-valueb      |               |               |
| **Social capital**  |                              |               |               |               |               |
| Civic participation | No participation             | 1780          | 1226          | <.001         |               |
|                     | Any participation             | 533           | 446           |               |               |
| Social cohesion     | No cohesion                  | 760           | 458           | <.001         |               |
|                     | Any cohesion                 | 1553          | 1214          |               |               |
| Reciprocity         | No support                   | 226           | 112           | <.001         |               |
|                     | Any support                  | 2087          | 1560          |               |               |
| **Other covariates**| Sex                          |               |               |               |               |
|                     | Men                          | 1154          | 854           | .066          |               |
|                     | Age (years)                  |               |               |               |               |
|                     | 20–39                        | 573           | 316           | <.001         |               |
|                     | 40–64                        | 1108          | 791           |               |               |
|                     | 65–79                        | 632           | 565           |               |               |
| Underlying diseases  | No                           | 1586          | 1055          | <.001         |               |
|                     | Yes                          | 727           | 617           |               |               |
| Marital status      | Unmarried                    | 920           | 567           | <.001         |               |
|                     | Married                      | 1393          | 1105          |               |               |
| Employment status   | Unemployed                   | 899           | 684           | .001          |               |
|                     | Employed                     | 1414          | 988           |               |               |
| Residential area    | Tokyo metropolitan area d    | 725           | 538           | .163          |               |
|                     | Other                        | 1588          | 1134          |               |               |
| Living arrangements | Living alone                 | 394           | 271           | .088          |               |
|                     | With others                  | 1919          | 1401          |               |               |
| Educational attainment | Below university graduate    | 1096          | 779           | .217          |               |
|                     | University graduate or above | 1217          | 893           |               |               |
| Annual household income | <3 million yen (approximately 26,000 USD) | 510          | 352           | .033          |               |
|                     | 3 to < 5 million yen [26,000 to <44,000 USD] | 637          | 475           |               |               |
|                     | 5 to < 7 million yen [44,000 to <61,000 USD] | 495          | 343           |               |               |
|                     | ≥7 million yen or more       | 671           | 502           |               |               |

aWe asked participants to indicate how likely they were to receive a COVID-19 vaccine booster. Five response options were provided: “very unlikely,” “moderately unlikely,” “neither,” “moderately likely,” and “very likely.” We defined “a participant having high intention to receive a COVID-19 vaccine booster” if a participant responded with “very likely” or “moderately likely.”
b*p-value was calculated using a chi-square test.

Information and receive instrumental support. Moreover, it can help them to obtain correct information regarding the effectiveness and safety of vaccines, which in turn may increase their perceived confidence in vaccines (i.e., the “confidence” aspect of the 3Cs model). Obtaining correct information about COVID-19 may also clarify the perceived risk and severity of COVID-19 (i.e., the “complacency” aspect of the 3Cs model), and reduce beliefs in conspiracy theory. Social capital may also help individuals receive vaccination-related instrumental support such as having someone accompany them to the vaccination center (i.e., the “convenience” aspect of the 3Cs model). Additionally, social capital can facilitate collective action to solve problems. Among individuals who are hesitant to receive the COVID-19 vaccine, some want to be
“freeloaders” who benefit from the indirect protection provided by other people being vaccinated. Social capital may reduce this type of thinking and promote willingness to be vaccinated for the sake of oneself and others in the community. This is referred to as “collective responsibility” in certain situations and is one of the key factors that reduce vaccine hesitancy. As such, social capital may improve various psychological factors associated with vaccine hesitancy.

This study has several limitations. First, we could not determine the causal pathways owing to the cross-sectional nature of our study. There could be a reverse causality issue: some unvaccinated individuals might have fewer interactions with the community to avoid COVID-19 infection. Second, participants were recruited from a single internet research company. Thus, the results may have been affected by selection bias. Third, although administration of the COVID-19 vaccine booster for the general public was not yet available at the time of the survey, there is a possibility that a very small number of participants who had already received a booster shot, such as high-risk older individuals, were included in this study. Fourth, this study did not evaluate the association between community-level social capital and COVID-19 vaccination. Regarding vaccines other than that of COVID-19, some previous studies report a positive association between community-level social capital and vaccine hesitancy, while others report a negative association. Further research is needed on the association between these two factors. Fifth, although the survey items measuring social capital are validated for older adults, the questionnaire has not been validated for younger adults. Finally, the generalizability of our results to other regions or communities is unclear. Social capital sometimes has a negative effect on health. A study in India reported a negative association between community-level social capital and completion of all recommended vaccinations by 12 months of age. Even in the case of COVID-19 vaccines, the influence of social capital on vaccination behavior may differ by region and community. Despite these limitations, our results provide further evidence to support the hypothesis that individual-level social capital is a possible factor in reducing COVID-19 vaccine hesitancy, even in a pandemic or infodemic.

In conclusion, individual-level social capital is associated with previous status of COVID-19 vaccination and intention to receive a COVID-19 vaccine booster in Japan. Our results suggest that members of the general public with individual-level social capital were more likely to receive the COVID-19 vaccine than those with no such social capital. Social capital may thus play an important role in the dissemination of COVID-19 vaccines. Fostering social capital during ordinary times may be effective in inhibiting vaccine hesitancy during a pandemic and infodemic.
Data availability statement

The data cannot be shared publicly because of the confidentiality-based restrictions placed by the Ethics Committee at Tokyo Medical University. The datasets used and/or analyzed during the present study are available from the corresponding author upon reasonable request.

Disclosure statement

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