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Themed Paper – Original Research

Unwillingness to cooperate with COVID-19 contact tracing in Japan

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ABSTRACT

Objectives: Contact tracing for COVID-19 relies heavily on the cooperation of individuals with authorities to provide information of contact persons. However, few studies have clarified willingness to cooperate and motivation to provide information for contact tracing. This study sought to describe willingness to cooperate and motivation to report contact persons for COVID-19 contact tracing among citizens in Japan, and to assess any associated sociodemographic factors.

Study design: Cross-sectional study.

Methods: This was an online-based survey using quota sampling. Participants were asked about their willingness to cooperate in reporting contacts for COVID-19 contact tracing if they tested positive. Participants also responded to questions regarding their reasons for cooperating or not cooperating and provided sociodemographic data. Multiple logistic regression analysis was performed to clarify associations between sociodemographic factors and willingness to cooperate.

Results: This study included 2844 participants. The proportion of participants who were not willing to cooperate in reporting contacts was 27.6%, with their main reasons being concerns about causing trouble for the other person and being criticised for revealing their names. Willingness to cooperate was lower among men, young adults and those with an educational level less than a university degree.

Conclusions: To improve the effectiveness of contact tracing, educational campaigns, such as reducing the fear and stigma associated with COVID-19, may be important. Furthermore, it is essential to understand that individuals may have contacts whom they do not wish to disclose to others and to be considerate when handling such situations.

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Introduction

Contact tracing is the process by which public health officials identify individuals who have been exposed to a person infected with a pathogen. Contact tracing is a standard procedure in the control of certain infectious diseases.^{1,2} In the coronavirus disease 2019 (COVID-19) pandemic, contact tracing is one of the key

strategies for mitigating the transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) to reduce the number of cases and mortality associated with COVID-19.^{3–5} COVID-19 contact tracing is mainly used to identify and provide supported quarantine to individuals who were in contact with people infected with SARS-CoV-2. In addition, contact tracing can also be used to find settings or events where the infection may have occurred.⁵

The first step in contact tracing is to identify people who have been in contact with confirmed COVID-19 cases. The standard method for identifying contacts is to interview an individual (or an individual's caregiver), although digital technology, such as contact tracing applications, are also now widely used.^{3,6} Whether an interviewer can elicit enough information regarding contacts from

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the infected individual or their caregiver depends on the interviewee's memory, willingness to cooperate and motivation to report contacts.² However, social stigma associated with COVID-19 disincentivises cooperation regarding contact tracing, because social stigma drives people to hide their illness to avoid discrimination.^{7–9} Social stigma has been observed in other infectious diseases, such as tuberculosis and sexually transmitted infections, and this reduces the effectiveness of contact tracing.^{10,11} In addition, social and economic insecurity may deter individuals from participating in contact tracing programmes.⁸ People who are socially insecure may be concerned that their social status would be threatened if it was known that they had been diagnosed with COVID-19.⁷ For individuals who are financially insecure, the reduction in their income because of the quarantine of family members may inhibit their willingness to cooperate with reporting contacts.³ These potential factors may make it difficult to identify all contacts by interview, even if there is recollection of all contacts.^{3,7} In fact, COVID-19 contact tracing does not work well in many countries.¹² One of the reasons for this is that contacts are not adequately revealed during interviews because there is a lack of trust in public health authorities.^{12,13} However, few studies have investigated willingness of individuals to cooperate and their motivation to report contacts for COVID-19 contact tracing among citizens, especially in Japan.^{8,9,12,13}

Therefore, the purpose of this study was to describe the willingness to cooperate in COVID-19 contact tracing, the motivation for willingness or unwillingness to cooperate, and to assess any associated sociodemographic factors in Japan.

Methods

Study sample and data collection

This was a cross-sectional study conducted using an online survey. The survey was conducted between 14 and 18 January 2021. At the time of the survey, the number of confirmed COVID-19 cases in Japan had significantly increased. In addition, the Japanese government had declared a state of emergency in the Tokyo metropolitan area on 7 January 2021, for the second time since April 2020.¹⁴ Participants in the study were recruited from the registrants of a Japanese Internet research service company, MyVoice Communication, Inc., which had approximately 1.07 million registered participants as of August 2021. This study aimed to collect data from 3000 men and women, aged 20–79 years, from all regions of Japan. Quota sampling based on age, sex and residential area was used. The 3000 participants were stratified by sex, age (5-year age groups) and residential area (i.e., Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku and Kyushu regions), then set a target number of respondents for each group to be consistent with the census data in Japan.

The Internet research service company randomly chose potential respondents from the registered participants and invited them to participate in the survey by email on 14 January 2021. The questionnaires were placed in a secured section of a Web site and potential respondents received a specific URL in their invitation email. When the number of participants who voluntarily responded to the questionnaire reached the target number of respondents for each group, responses were no longer accepted for that group. The survey was concluded on 18 January 2021 when the target number of respondents was reached for all groups. Reward points, valued at 80 yen (approximately 0.7 US dollars as of November 2021), were provided as incentives 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 participants' willingness to cooperate in reporting contacts and reasons for COVID-19 contact tracing

To measure willingness to cooperate in reporting contacts and reasons for COVID-19 contact tracing, survey items were developed based on the COVID-19 Snapshot Monitoring questionnaire, which was created by the World Health Organisation (WHO) in Europe to monitor public perceptions of COVID-19.^{15,16} Participants were asked whether they would share all the names of people they had been in contact with if they tested positive for COVID-19 and were asked to share the names with health authorities. Two response options were provided: 'I would share all names for sure' and 'I may not share all names'. Participants were then asked to provide a reason for their response using multiple answer questions: choices for why participants would share all names for sure included 'I believe this helps stop the spread of COVID-19' and 'this is my responsibility as a citizen'; choices for why participants may not share all names included 'I believe people would blame me for having shared their name' and 'I would cause inconvenience to the people whose names I share'.

Assessment of sociodemographic factors

Participants reported their sex, age, marital status, occupation, residential area and living arrangement. The research company provided categorised data on educational attainment and annual household income level.

Statistical analysis

Regarding participants' willingness to cooperate in reporting information about contacts, if the participants responded 'I would share all names for sure', it was determined that participants were willing to cooperate and those who chose 'I may not share all names' were deemed an unwilling to cooperate. This study reports the percentage of participants who were and were not willing to cooperate with contact tracing. This study also determined the proportions of the reasons for which the participants were willing and not willing to cooperate. The characteristics of the participants who were willing to cooperate and those who were not were compared using a Chi-squared test.

Multiple logistic regression analysis was performed to clarify the association between each sociodemographic factor and the willingness to cooperate in reporting contacts. The dependent variable was set as a dichotomous variable, coded as '1' if the participant was willing to cooperate and '0' if not willing. The independent variables were sex, age (20–39, 40–59 and 60–79 years), marital status, occupation, residential area, living arrangement, educational attainment and household income. Statistical analyses were performed using SPSS Statistics for Windows, version 28 (IBM Japan, Tokyo, Japan). Two-sided *P*-values < 0.05 were considered to be statistically significant.

Results

Of the 3000 participants selected for this study, 156 participants with incomplete data were excluded from the analysis. Therefore, the analysis set consisted of 2844 participants (age range 20–79 years, median: 51 years, SD: 15.8). See [Table 1](#) for participant characteristics.

The proportion of participants who were not willing to cooperate in reporting contacts was 27.6%. A significantly higher proportion of participants who were not willing to cooperate in reporting contacts were men, aged 20–39 years or 40–59 years and

Table 1
Participant characteristics.

Characteristic	Total		Participants willing to cooperate in reporting contacts ^a		Participants unwilling to cooperate in reporting contacts		P-value ^c
	N = 2844		N = 2058		N = 786		
	n (%)		n (%)		n (%)		
Sex							
Men	1406	(49.4)	957	(68.1)	449	(31.9)	<0.001
Women	1438	(50.6)	1101	(76.6)	337	(23.4)	
Age (years)							
20–39	752	(26.4)	488	(64.9)	264	(35.1)	<0.001
40–59	1095	(38.5)	787	(72.5)	308	(28.4)	
60–79	997	(35.1)	783	(78.5)	214	(21.5)	
Marital status							
Not married	1147	(40.3)	787	(68.6)	360	(31.4)	<0.001
Married	1697	(59.7)	1271	(74.9)	426	(25.1)	
Occupation							
Company employee	958	(33.7)	644	(67.2)	314	(32.8)	<0.001
Self-employed	162	(5.7)	119	(73.5)	43	(26.5)	
Professional	113	(4.0)	78	(69.0)	35	(31.0)	
Civil servant	104	(3.7)	81	(77.9)	23	(22.1)	
Student	46	(1.6)	25	(54.3)	21	(45.7)	
Full-time homemaker	588	(20.7)	470	(79.9)	118	(20.1)	
Part-time job	389	(13.7)	272	(69.9)	117	(30.1)	
Unemployed or retired	484	(17.0)	369	(76.2)	115	(23.8)	
Residential area							
Tokyo metropolitan area ^b	893	(31.4)	658	(73.7)	235	(26.3)	0.286
Other areas	1951	(68.6)	1400	(71.8)	551	(28.2)	
Living arrangement							
Alone	494	(17.4)	345	(69.8)	149	(30.2)	0.167
With other	2350	(82.6)	1713	(72.9)	637	(27.1)	
Educational level							
University graduate or above	1477	(51.9)	1072	(72.6)	405	(27.4)	0.788
Below university graduate level	1367	(48.1)	986	(72.1)	381	(27.9)	
Annual household income							
<3 million yen [approximately <26,000 USD]	635	(22.3)	461	(72.6)	174	(27.4)	0.977
3 to <5 million yen [26,000 to <44,000 USD]	797	(28.0)	572	(71.8)	225	(28.2)	
5 to <7 million yen [44,000 to <61,000 USD]	599	(21.1)	434	(72.5)	165	(27.5)	
≥7 million yen or more [≥61,000 USD]	813	(28.6)	591	(72.7)	222	(27.3)	

^a Participants were asked whether they would share all names of people with whom they had been in contact if they tested positive for COVID-19 and were asked to share names with healthcare authorities. Two response options were provided: 'I would share all names for sure', and 'I may not share all names'. When a participant responded 'I would share all names for sure' it was determined that the participants were willing to cooperate in reporting contacts and if the participant responded 'I may not share all names', they were not willing to cooperate.

^b Tokyo metropolitan area includes Tokyo, Kanagawa, Saitama and Chiba prefectures.

^c P-value was calculated using the Chi-squared test.

were not married compared with women, those aged 60–79 years and those who were married.

The predominant reasons for willingness to cooperate in reporting contacts for COVID-19 were 'I believe this helps stop spread of COVID-19' (84.8%) and 'This way I can protect other people' (76.4%) (Fig. 1). The predominant reasons for unwillingness to cooperate were 'I would cause inconvenience for the people whose names I share' (47.6%) and 'I believe people would blame me for having revealed their name' (33.7%) (Fig. 2).

In terms of sociodemographic factors, men (odds ratio [OR]: 0.62, 95% confidence interval [95% CI]: 0.51–0.76), aged 20–39 years (OR: 0.57, 95% CI: 0.44–0.74) or 40–59 years (OR: 0.77, 95% CI: 0.62–0.96), and those with an education level less than a university degree (OR: 0.79, 95% CI: 0.66–0.95) were significant factors for not being willing to cooperate in reporting contacts (Table 2). Unemployment or retirement was a significant factor in the willingness to cooperate in reporting contacts compared with being company employees (OR: 1.39, 95% CI: 1.04–1.85).

Discussion

This study found that 27.6% of participants would not be willing to cooperate in reporting contacts for COVID-19 contact tracing. The main reasons were being concerned about causing trouble for the persons whose names were reported and being criticised for reporting these names. Some sociodemographic factors, such as sex, age and educational level, were associated with willingness to cooperate and with the motivation to report contacts. The study results can be used to understand the problems of contact tracing and to consider measures to address these issues.

Some studies have reported the potential for concealment of COVID-19 information among citizens.^{9,13,17} O'Connor et al. showed that 55% of COVID-19 patients experiencing some symptoms tried to conceal their symptoms when asked by others.¹⁷ Schneider et al. reported that only 50% of cases for COVID-19 contact tracing in the USA disclosed at least one person with whom they had been in contact.⁹ These previous studies and results from the present study

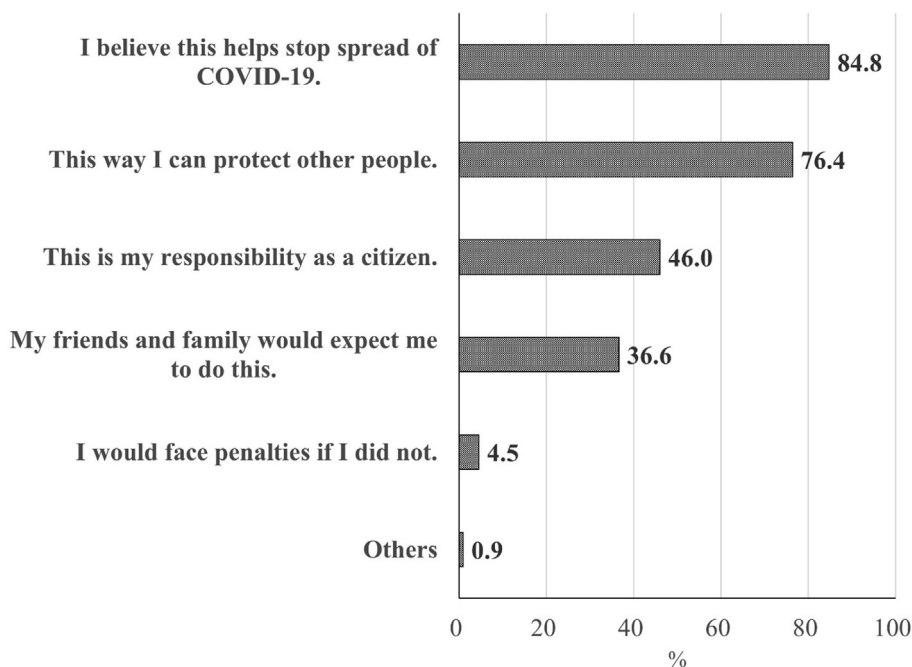


Fig. 1. Reasons for willingness to cooperate in reporting contacts for COVID-19.

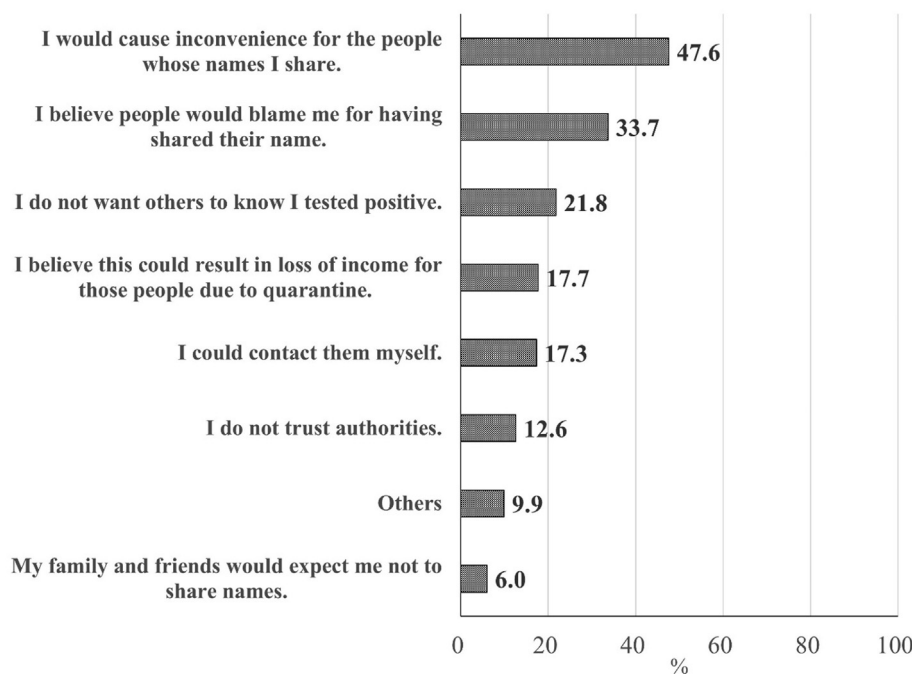


Fig. 2. Reasons for unwillingness to cooperate in reporting contacts for COVID-19.

suggest that collecting information related to COVID-19 by interviewing patients may not be sufficient to elicit necessary information, even if all the contacts are recollected.

The current results showed that participants who were men, young adults or those with a low educational level tended to be unwilling to cooperate in reporting contacts, compared with participants who were women, older adults or had a higher level of education. When contact tracing by interview is performed with men, young adults or those with a low educational level, it is

important to consider that it may not be possible to elicit all contact persons. Regarding differences by sex, a previous study reported that women tend to be more open with communication about their health needs than men.¹⁸ In the context of COVID-19, it has been reported that women are less likely than men to conceal information, such as COVID-19-related symptoms.¹⁷ Regarding age, previous studies have reported that honesty increases with adulthood, and a similar tendency has been reported for COVID-19-related health information.^{17,19,20} The differences in the willingness to

Table 2
Individual factors associated with willingness to disclose persons with whom they have had contact.

Characteristic	N	Odds ratio ^a	95% Confidence interval	P-value
Sex				
Men	1406	0.62	(0.51–0.76)	<0.001
Women	1438	1.00		
Age (years)				
20–39	752	0.57	(0.44–0.74)	<0.001
40–59	1095	0.77	(0.62–0.96)	0.023
60–79	997	1.00		
Marital status				
Not married	1147	1.00		
Married	1697	1.07	(0.85–1.35)	0.549
Occupation				
Company employee	958	1.00		
Self-employed	162	1.24	(0.84–1.83)	0.271
Professional	113	0.96	(0.63–1.48)	0.860
Civil servant	104	1.59	(0.98–2.59)	0.062
Student	46	0.65	(0.35–1.21)	0.173
Full-time homemaker	588	1.21	(0.88–1.66)	0.234
Part-time job	389	0.95	(0.72–1.27)	0.745
Unemployed or retired	484	1.39	(1.04–1.85)	0.027
Residential area				
Tokyo metropolitan area ^b	893	1.10	(0.91–1.32)	0.333
Other	1951	1.00		
Living arrangement				
Alone	494	1.00		
With other	2350	1.02	(0.78–1.33)	0.882
Educational level				
University graduate or above	1477	1.00		
Below University graduate level	1367	0.79	(0.66–0.95)	0.013
Annual household income				
<3 million yen [approximately <26,000 USD]	635	0.97	(0.73–1.27)	0.805
3 to <5 million yen [26,000 to <44,000 USD]	797	0.92	(0.73–1.17)	0.496
5 to <7 million yen [44,000 to <61,000 USD]	599	1.01	(0.79–1.29)	0.954
≥7 million yen or more [≥61,000 USD]	813	1.00		

^a Odds ratios were calculated and adjusted for all individual variables.
^b Tokyo metropolitan area included Tokyo, Kanagawa, Saitama and Chiba prefectures.

cooperate by sex and age in our results may be due to such differences in open communication and honesty. Meanwhile, the difference in willingness to cooperate in reporting contacts by educational level in the present study results may be because of the difference in perceived social stigma level related to COVID-19 infection. Social stigma associated with COVID-19 infection is one of the factors that inhibit willingness to cooperate in reporting contacts among citizens.^{7,8} The perceived social stigma level varies by individual. Perry reported that individuals with low educational levels have a high level of perceived social stigma associated with COVID-19 infection.⁸

A previous study in the USA showed that social and economic insecurity was associated with unwillingness to cooperate with COVID-19 contact tracing.⁸ However, the present study results showed no association between household income level and willingness to cooperate in contact tracing. The possible factor contributing to this difference may be the dissimilarity in health-care costs associated with COVID-19 in the two countries. One of the reasons underlying the unwillingness of economically insecure persons in the USA to cooperate relates to concerns about medical costs.⁸ In contrast, in Japan, most of the costs of testing and treatment related to COVID-19 are covered by medical insurance and public funds, and the cost to the individual is minimal.²¹ Thus, household income may not impact the willingness to cooperate with COVID-19 contact tracing in Japan.

The extent to which a contact can be identified depends on the memory and willingness of the patient or the individual's caregiver.² In the present study, the main reasons for not being willing to cooperate to report contacts were concerns about causing trouble for the persons whose names were reported and about

being criticised for reporting them. This result may suggest that not only social stigma associated with COVID-19 but also concerns about the burden that would be placed on the contact persons if they needed to be quarantined, and the problems that arise when contact is brought to light, may lower the willingness to cooperate with contact tracing among citizens in Japan. Further research may be needed to clarify the association between these factors and willingness to cooperate with contact tracing. Regarding social stigma, WHO guidelines on social stigma associated with COVID-19 state measures to prevent stigma, such as using people-first language that respects and empowers people, spreading the facts and engaging social influencers.⁷ To improve the willingness to cooperate with COVID-19 contact tracing, an educational campaign based on these recommendations and involving social media may be important.⁷ In addition, if the contacted person needs to be quarantined, they may incur financial losses, particularly for those in informal or hourly employment. Individuals may face other problems, such as being dismissed or penalised for missing important opportunities, not appearing at court hearings or being unable to take school examinations. Legislation and a system for compensating financial losses and preventing penalties due to quarantine may be required.³ Furthermore, there could be some contacts in an individual's life that they may not wish to disclose, such as cheating on their partner, gatherings related to their sexuality and parties or assemblies where anonymity is required. It is possible that the individual may feel uneasy about disclosing information of such contacts so as not to cause trouble for themselves and the contacted persons. It is important to understand that there are such circumstances in the lives of individuals and to offer discretion.²² A system that ensures privacy and anonymity during

contact tracing and testing may be a factor in mitigating these concerns.²² The extent to which contact information can be elicited depends not only on the willingness to cooperate but also on the individual's memory; thus, it is important that the interviewer is trained to successfully elicit relevant information from the individual's memories and use digital technology.^{2,12,23}

The strengths of the present study include the large sample size and selection of participants from all regions of Japan using quota sampling. However, there are some limitations of this study that must be considered. First, participants were recruited from a single Internet research company; thus, the results may be impacted by this selection bias. Second, the degree of willingness to cooperate in reporting contacts was not measured in this study. There may be varying degrees of willingness to cooperate, ranging from very uncooperative to very cooperative, considering that there may be some information of contacts that they wish to conceal, among participants who answered that they might not share all names. In addition, the degree of willingness to disclose contacts may be different based on the type of contact person, such as work colleagues, private acquaintances and family members. Third, in this study, we evaluated the willingness to cooperate in reporting contacts if the participants tested positive for COVID-19. We did not evaluate the willingness in any actual COVID-19 patients. The willingness to cooperate among actual COVID-19 patients may differ from the results of this study. Fourth, the participants were asked to respond with a choice of reasons why they would or would not cooperate with contact tracing; however, the options presented may not completely or clearly represent the true reason for the participant. To clarify the reasons, it may be necessary to use a questionnaire based on the principles of creating patient-reported outcome measures, such as conducting focus group interviews and checking validity and reliability. Fifth, the results may only be directly applied to Japanese populations. Japan is a more collective society than most Western countries.²⁴ The willingness to cooperate in reporting contacts in the Japanese population may be higher than in Western countries, since Japanese people may put the interests of society ahead of personal privacy. In the case of other populations with different cultural, ethnic and geographical backgrounds, the proportion of participants who are not willing to cooperate in reporting contacts may be very different. Despite these limitations, to the best of our knowledge, no previous study has clarified the willingness to cooperate in reporting contacts for COVID-19 contact tracing in Japan or evaluated their motivation, or assessed the associated sociodemographic factors.

In conclusion, for COVID-19 contact tracing in Japan, this study found that 27.6% of participants would not be willing to cooperate in reporting all persons with whom they have had contact, mainly due to concerns about causing problems for the persons whom they are reporting and being criticised for reporting their names. The results indicate that the willingness to cooperate in reporting contacts was lower among several sociodemographic groups, such as men, those aged 20–59 years and those with an educational level less than a university degree. To improve the effectiveness of contact tracing, educational campaigns to reduce the fear and stigma associated with COVID-19 may be important. In addition, the present study results also suggest that unwillingness to cooperate with contact tracing in Japan is not only due to social stigma associated with COVID-19 but also concerns about the burden placed on the contact persons if they needed to be quarantined and problems that arise when the contact is brought to light. It may be necessary to understand that individuals have contacts they do not wish to disclose to others and to be considerate when handling such situations. These results may be useful in enhancing the

efficacy of contact tracing for COVID-19 and other contagious infections in the community.

Author statements

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Ethical approval

This study was approved by the Ethics Committee of Tokyo Medical University, Tokyo, Japan (No: T2019-0234). Informed consent was obtained from all respondents.

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Competing interests

The authors declare that they have no competing interests.

References

- Porta M. *A dictionary of epidemiology*. 6th ed. New York: Oxford University Press; 2014. p. 31.
- Garry M, Hope L, Zajac R, Verrall AJ, Robertson JM. Contact tracing: a memory task with consequences for public health. *Perspect Psychol Sci* 2021;**16**(1): 175–87. <https://doi.org/10.1177/1745691620978205>.
- World Health Organization. Contact-tracing in the context of covid-19. <https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19> [accessed 17 April 2022].
- World Health Organization. Critical preparedness, readiness and response actions for covid-19. <https://www.who.int/publications/i/item/critical-preparedness-readiness-and-response-actions-for-covid-19> [accessed 17 April 2022].
- Keeling MJ, Hollingsworth TD, Read JM. Efficacy of contact tracing for the containment of the 2019 novel coronavirus (covid-19). *J Epidemiol Community Health* 2020;**74**(10):861–6. <https://doi.org/10.1136/jech-2020-214051>.
- Zastrow M. Coronavirus contact-tracing apps: can they slow the spread of covid-19? *Nature* 2020. <https://doi.org/10.1038/d41586-020-01514-2>.
- World Health Organization. A guide to preventing and addressing social stigma associated with covid-19. <https://www.who.int/publications/m/item/a-guide-to-preventing-and-addressing-social-stigma-associated-with-covid-19> [accessed 17 April 2022].
- Perry BL. Contact tracing could exacerbate covid-19 health disparities: the role of economic precarity and stigma. *Am J Public Health* 2021;**111**(5):778–81. <https://doi.org/10.2105/AJPH.2021.306244>.
- Schneider J, Love W, Rusie L, Flores A, Tadesse B, Hazra A, et al. Covid-19 contact tracing conundrums: insights from the front lines. *Am J Public Health* 2021;**111**(5):917–22. <https://doi.org/10.2105/AJPH.2021.306200>.
- Daftary A, Frick M, Venkatesan N, Pai M. Fighting TB stigma: we need to apply lessons learnt from HIV activism. *BMJ Glob Health* 2017;**2**:e000515. <https://doi.org/10.1136/bmjgh-2017-000515>.
- Garcia PJ, Miranda AE, Gupta S, Garland SM, Escobar ME, Fortenberry JD. The role of sexually transmitted infections (STI) prevention and control programs in reducing gender, sexual and STI-related stigma. *E Clinical Med* 2021;**33**: 100764. <https://doi.org/10.1016/j.eclinm.2021.100764>.
- Lewis D. Why many countries failed at COVID contact-tracing - but some got it right. *Nature* 2020;**588**:384–7. <https://doi.org/10.1038/d41586-020-03518-4>.
- Lash RR, Moonan PK, Byers BL, Bonacci RA, Bonner KE, Donahue M, et al. COVID-19 case investigation and contact tracing in the US, 2020. *JAMA Netw Open* 2021;**4**:e2115850. <https://doi.org/10.1001/jamanetworkopen.2021.15850>.
- Prime minister of Japan, and his cabinet, Press Conference by the Prime Minister. https://japan.kantei.go.jp/99_suga/statement/202101/_00005.html [accessed 17 April 2022].
- Betsch C, Wieler LH, Habersaat K, COSMO group. Monitoring behavioural insights related to covid-19. *Lancet* 2020;**395**(10232):1255–6. [https://doi.org/10.1016/S0140-6736\(20\)30729-7](https://doi.org/10.1016/S0140-6736(20)30729-7).

16. World Health Organization regional Office for Europe. *Survey tool and guidance: behavioural insights on COVID-19* (produced by the WHO European Region), <https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/risk-communication-and-community-engagement/who-tool-for-behavioural-insights-on-covid-19/survey-tool-and-guidance-behavioural-insights-on-covid-19-produced-by-the-who-european-region>, 29 July 2020. [Accessed 17 April 2022].
17. O'Connor AM, Evans AD. Dishonesty during a pandemic: the concealment of covid-19 information. *J Health Psychol* 2022;**27**(1):236–45. <https://doi.org/10.1177/1359105320951603>.
18. Weisman CS. Communication between women and their health care providers: research findings and unanswered questions. *Publ Health Rep* 1987;**102**(4 Suppl):147–51.
19. Ashton MC, Lee K. Age trends in hexaco-pi-r self-reports. *J Res Pers* 2016;**64**: 102–11. <https://doi.org/10.1016/j.jrp.2016.08.008>.
20. Debey E, De Schryver M, Logan GD, Suchotzki K, Verschuere B. From junior to senior pinocchio: a cross-sectional lifespan investigation of deception. *Acta Psychol* 2015;**160**:58–68. <https://doi.org/10.1016/j.actpsy.2015.06.007>.
21. Ministry of Health, Labour and Welfare, Japan. An outline of the Japanese medical system, <https://www.mhlw.go.jp/english/policy/health-medical/health-insurance/index.html> [accessed 17 April 2022].
22. Working group on measures to prevent the spread of infections in entertainment districts in large cities. Agenda for third meeting, https://www.cas.go.jp/jp/seisaku/ful/kanrakugai_wg_3.pdf [accessed 17 April 2022]. [Japanese].
23. COVID-19 National Emergency Response Center. Epidemiology & case management team, korea centers for disease control & prevention. Contact transmission of COVID-19 in South Korea: novel investigation techniques for tracing contacts. *Osong Public Health Res Perspect* 2020;**11**(1):60–3. <https://doi.org/10.24171/j.phrp.2020.11.1.09>.
24. Hofstede insights. Country comparison what about Japan, <https://www.hofstede-insights.com/country-comparison/japan/>[accessed 17 April 2022].