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What is the appropriate information delivery method? Post-pandemic survey in Japan, Germany, and the United States

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Abstract

Purpose – This paper explores people's responses and perception of information supplied by actors across various societal sectors during the COVID-19 pandemic in Japan, Germany, and the United States.

Design/methodology/approach – Descriptive and regression analyses were conducted using survey data covering 1,572 individuals in the three countries.

Findings – There are three key findings. First, information published by governments is considered highly reliable, while the perception of fairness was evaluated as second lowest after news media. Conversely, the perceived fairness of information provided by healthcare professionals is ranked relatively high. Information reliability from family/friends is almost as high as information disseminated by government and healthcare professionals, and the perceived fairness is the highest. Second, people transmit information from family/friends to others as actively as information given by governments and news media. Government information influences daily life the most, although the impact of information provided by news media and family/friends is also significant. Third, people tend to obtain information mainly from family/friends, news media, and government. However, the contact time for collecting information through social media is relatively low.

Originality/value – The study examines individual differences in information perception and attitude and analyses the association with individual characteristics to identify important factors.

Keywords Information delivery, Information perception, Civil behaviours, COVID-19, Japan, Germany, The United States

Paper type Research article

Introduction

In the present era of data deluge, the COVID-19 pandemic has highlighted critical problems regarding delivery and sharing of information with various stakeholders. For instance, information about the pandemic was occasionally perceived as biased or manipulated to protect a specific group's interest. In fact, the Australian Strategic Policy Institute (2020) reported cases of disinformation regarding the COVID-19 crisis for certain strategic gains. Mistrust in the information provided by authorised organisations, such as government agencies, expert committees, and major media channels, can divide societies and lead to conflict and confrontation, which could impede the entire community's integrated response to emergencies.

Similarly, as information can also be delivered by other individuals through social media channels, information scrutiny has emerged as a serious issue for many people. For instance, Li *et al.* (2020) reported that 27.5 percent of their observations, comprising 69 COVID-19-related videos uploaded on YouTube, included non-factual misleading information. While

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information from unauthorised actors can transmit critical information that is not mentioned by authorised agencies, unfounded rumours by these actors sometimes confound people and cause chaos in the society. In fact, stigma and discrimination caused by the spread of rumours was observed during the COVID-19 pandemic, specifically to exclude infected patients, their families, medical staff, and a specific race or nationality (Fujii *et al.*, 2022). Nevertheless, studies that identify factors affecting chaotic information flows and their outcome due to crises are currently ongoing.

During emergency situations, voluntary cooperation is important because the government may not respond to a crisis immediately, and market mechanisms take time to regain functionality. Therefore, this paper explores effective information provision from various actors to incentivise citizen's voluntary cooperation in an emergency. This research highlights the implications of effective information management during an emergency for government agencies, municipalities, and regulatory authorities by revealing people's perception of information and their attitude towards information collection and distribution.

The contribution of this work is fourfold. First, it clarifies the relationship between individual characteristics, such as sex, age, and family size, and response and perception of infection-related information during a pandemic. Although some studies such as Yamamura (2013) show that individual characteristics influence cooperative behaviours following a natural disaster, pandemics have unique characteristics that are not observed in other crises situations. For instance, while cooperation is important in volunteering activities after a natural disaster, social distancing is important during a pandemic to avoid the spread of infection. Moreover, while natural disasters damage people and physical assets, pandemics affect people, indicating that cultural, environmental, and social factors affect individual behaviours. Therefore, this study attempts to identify critical individual characteristics with a particular focus on a pandemic.

Second, the impact of people's information perception and behavioural transformation is revealed. While previous studies on the COVID-19 pandemic mostly investigated observed behaviours such as wearing face masks and hand hygiene (Smith *et al.*, 2022), social distancing (Abdelrahman, 2022), changes in the patterns of outdoor recreational activities (Rice *et al.*, 2020; Landry *et al.*, 2021), and saving and spending (Cox *et al.*, 2020), this study examines individuals' identification and acknowledgment of information, such as evaluating the reliability and fairness of the information source. To the best of our knowledge, this is amongst the pioneering studies that focuses on these issues. By revealing the tendencies of information perception and evaluation by individual characteristics, future information delivery policies in the event of another pandemic could be more subtilised and targeted.

Third, the perceived characteristics of multiple sources of information are compared. Pandemic-related information is provided by the government and individuals such as healthcare professionals, general community, family and friends. While previous studies on the COVID-19 pandemic focused mainly on government policies (Cheng *et al.*, 2020; Hale *et al.*, 2021; Roziqin *et al.*, 2021; Toshkov *et al.*, 2022) and established news media (Castriota *et al.*, 2023), the impact of unauthorised individuals, such as field medical staff and social media influencers, is widely recognised in the post-pandemic period. Similarly, information from the immediate environment, such as family and friends, had a major impact on people's decision-making during the pandemic. The authors compare how participants evaluated the reliability and fairness of information imparted by authorised government agencies and major media channels versus that communicated by unauthorised individuals.

Finally, this paper examines if individuals' responses and evaluation of information differ by country. As people's characteristics differ by country, three countries are selected as representative examples of each region: Japan (Asia), the United States (North and South Americas), and Germany (Europe).

Literature review

Studies on cultural and institutional differences in communication

Theoretical perspectives on differences in information perception and evaluation are found in cultural, institutional, and communication theories. Hall (1976) argues that in high-context cultures, such as Japan, communication is largely non-verbal and relies on shared contexts and relationships, while in low-context cultures, such as the United States, it is explicit and verbalised. Hofstede's cultural dimensions model (Hofstede, 1984, 2011; Hofstede *et al.*, 2010) identifies value differences across countries in terms of power distance, uncertainty avoidance, individualism or collectivism, masculinity or femininity, long-term or short-term orientation, and indulgence or restraint as determinants of decision-making and information exchange. Based on their model, the cultural values of the sample countries in this study differ: Japan scores high on uncertainty avoidance and masculinity, with a long-term orientation; the United States scores high on individualism with a short-term orientation; while Germany lies between these extremes. Pharr and Putnam (2000) reported declining trust in the government in many developed countries due to poor political performance. They identify decreased political capacity, the erosion of fidelity, and changes in the information environment and evaluation criteria as sources of the problem. They also note country-specific patterns of political trust: in Japan, trust in democratic institutions remains relatively resilient, yet trust in political parties and the legislature is persistently weak; in contrast, in the United States, political distrust is more pervasive, extending beyond partisan actors to encompass governmental institutions themselves. The Culture Factor Group (2025) provides methods for measuring such cultural differences across countries.

Most prior studies assume normal conditions for communication and information evaluation situations. However, in emergencies such as a pandemic, information perception can change due to high environmental risk and uncertainty. Effective targeted information policies must therefore consider both cultural and institutional factors and individual characteristics, such as age, gender, and employment. This study focuses on individual behaviours during the COVID-19 pandemic.

Studies on behavioural changes during pandemics

Most previous studies on individual behaviours during the COVID-19 pandemic focus on behavioural changes during and after the pandemic based on individual characteristics such as age, sex, employment, and place of residence. For instance, Rice *et al.* (2020) revealed that people living in urban areas reduced outdoor recreation activities versus those living in rural areas during the pandemic.

Some studies considered unobserved individual characteristics as determinants of behavioural changes. Clements (2020) gauges the impact of individuals' level of knowledge about the COVID-19 symptoms on participation in social events. His results indicate that while knowledge levels vary by observed individual characteristics such as sex and age, adequate knowledge about the infection reduced outdoor activities. He interprets that, as an individual's knowledge level generally enhances understanding of science and trust in scientific organisations, reasonable knowledge about COVID-19 enhanced an individual's cooperation and support for a public policy. Müller and Rau (2021) analysed the impact of economic preferences and attitudes on compliance behaviours during the COVID-19 crisis. They investigated the determinants of three behaviours (staying home, avoiding crowds, and testing for the virus) from the perspective of an individual's unobserved factors, including the level of self-recognised trustworthiness, honesty, trust, patience, present bias, and risk tolerance. The results showed that patience enhances staying home and avoiding crowds, while risk tolerance decreases crowd avoidance behaviours. Abdelrahman (2022) examined the impact of personality traits and risk perception on infection prevention behaviours such as social distancing and staying home. Among the personal traits, Abdelrahman (2022) showed that agreeableness is negatively related to social distancing, while conscientiousness

and neuroticism are positively related. Nevertheless, studies investigating individuals' information perception as critical determinants of behavioural changes have not been sufficiently accumulated.

The above-mentioned studies did not explicitly assume that individuals can receive information from a different source. Although Laato *et al.* (2020) examined the relationship between online information and unverified information-sharing activities, varying characteristics among information sources are beyond their research foci. The analysis of multiple information sources seems important for effective information delivery policies, as people's perception of information can differ by source. For example, people sometimes regard information provided by family, colleagues, and friends as more reliable than government news. This might result in people following the advice of individuals with whom they share a close relationship than government recommendations. To understand the determinants of behavioural changes among individuals and formulate policies that target each cluster of people, it is necessary to reveal differences in information perception by individual characteristics. Moreover, comparison of multiple countries was beyond the previous studies' research foci. As the people's response to the pandemic differed by political and cultural characteristics, country-level analyses are necessary for policymaking.

Methodology

Research framework

This study explored how information from multiple actors had a varied impact on people's perceptions and behaviour during the COVID-19 pandemic. The research framework is shown in Figure 1. The authors assumed that pandemic-related information is provided through government announcements, articles published in news media, social media communication by healthcare professionals and non-professionals, and conversations with people who share a close relationship (family, friends, colleagues). Such information influences personal attitudes, which comprise of information perception and behaviour. Information perception, defined by the reliability and fairness of the information, provokes behaviour, which is defined by behavioural changes in daily activities (hereafter referred to as 'influence') and transmission of information ('transmission'). Personal characteristics, including gender, age, and family size, are assumed to influence these relationships.

As previous studies focused on only a part of this framework, analysing the entire framework is considered a significant contribution. For instance, Rice *et al.* (2020) focused on

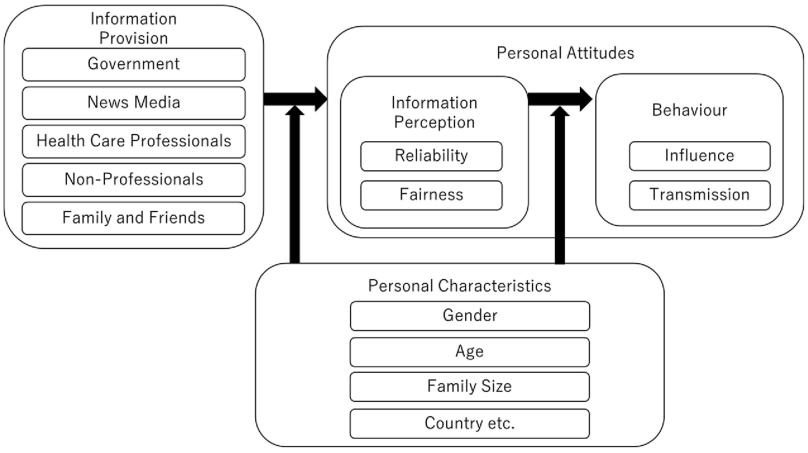

Figure 1. Research Framework. Source: By authors

the effects of personal characteristics on behaviour, while Clements (2020) and Abdelrahman (2022) examined the impact of information perception on behaviour. The effects of information provision by source were beyond research foci in most of studies.

Based on this framework, two analyses were conducted: (i) descriptive analysis for the relationship between information provision and personal attitudes, (ii) regression analysis for the relationship between information perception and behaviour. The first analysis aimed to understand the differences in perception by information source, and the second analysis identified causal effects of the perception on behaviour. Since several information sources are compared by personal characteristics, descriptive analyses using graphs are suitable for the first analysis. The second analysis employs ordered probit model for a regression, which is suitable for statistically testing the relationship.

Survey design

The data were collected in January 2023, the convalescent phase of the pandemic, from online surveys implemented in Japan, Germany, and the United States. The sample comprised 1,572 individuals, 532 in Japan, 507 in Germany, and 533 in the United States, with the participants aged between 20 and 65 years. Implementation was outsourced to a marketing research company. The survey was distributed to members registered in a survey panel, and participants who consented to our survey answered it. The sample was allocated by sex and age to avoid bias towards certain strata of the population.

Reliability was measured using a 5-point Likert scale by inquiring about the validity and reliability of the information. The fairness attribute was measured using a 5-point Likert scale by inquiring an inverse question of the fairness, that is, whether a respondent thinks the truth is being deliberately concealed when information is provided. The score was reversed so that higher scores indicate higher perception of fairness. Influence and transmission of information were respectively measured as ‘to what extent is a respondent’s behaviour in everyday life influenced by the information’, and ‘to what extent does a respondent communicate information to others’. In addition, time for data collection was inquired at source to understand the different weights across sources. The question was ‘for approximately how many minutes per day do you engage with information about COVID-19 via each of the following methods in an average day?’. As it may be difficult for respondents to provide the exact number of minutes, measurement errors were included in the provided answers. Therefore, we referred to these values as the relative weight of contact time with each information source.

Personal characteristics include country, sex, age, family size, prefecture/state of residence, and experience of contracting the infection. Age was measured based on five categories (20-29, 30-39, 40-49, 50-59, and 60-65 years) and family size was measured by the number of people in a participant’s household. Residence was based on prefecture/state level, replaced by the regional gross domestic product (GDP) to measure the level of regional economic strength in a respondent’s area of residence. Infection experiences were measured based on the respondent contracting the COVID-19 infection or if their family, friends, acquaintances, classmates or colleagues had contracted the infection.

Results and discussion

Overview of results

Figure 2 shows the average scores for perception, influence, and transmission of information for the entire sample. First, respondents’ perception of reliability was highest for government information (a score of 3.12), while perceived fairness was second lowest (2.71), after news media narratives (2.74). These findings indicate that while government information is deemed confirmed and established, people consider some of the information as deliberately obscured for political reasons, or the government is compelled to protect specific stakeholders’ interests.

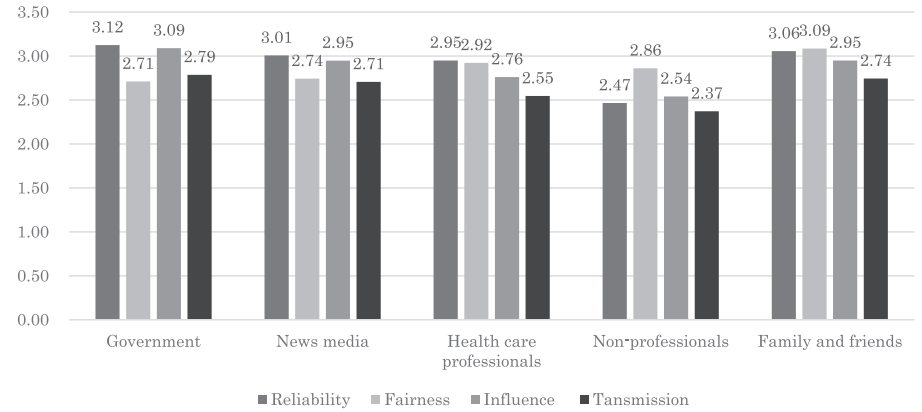

Figure 2. Information Perception/Behaviour by Source (5-point Likert Scale). Source: By authors

As it is common for individuals to access informal information from various sources, including social media, people can confirm and supplement formal information with little effort in recent years. Therefore, they can find information that is not available in formal sources using informal resources, which could sometimes result in their evaluation that formal information may be insufficient, or deliberately obscured. Moreover, in Figure 2, bar shapes for news media are similar to those for government. A possible explanation is that people consider news media narratives as subject to government regulation and control, although it is not possible to assess if this is true with our current data.

Second, participants perceived healthcare professionals as less likely to have any hidden agenda in sharing information than government, as the score of 'fairness' is 2.92 in the former and 2.71 in the latter. This indicates that people consider information from field staff as more decisive and trustworthy than the government's public communication. Notably, bar shapes for healthcare professionals are similar to those for family and friends, implying that public attitudes towards these professionals are close to those towards people with whom they have close relationships. Additionally, information communicated by family and friends is perceived to be as reliable as that by government, and the perceived fairness is highest among these five sources. This indicates that people believe that information shared by family and friends is unbiased because they do not consider them as being intentionally deceitful.

Figure 2 shows that people communicate information received from family and friends to others as actively as information released by the government and news media. Government information influences people's daily lives most, although the impact of information from news media and family and friends is also significant. These results indicate that the government's public communication is the most powerful driver of behavioural change, and information gathered from the immediate environment also influences individual behaviours. Social media information, stated as 'non-professionals' in Figure 2, has lowest reliability, even though the perceived fairness level is high, which contrasts with government information.

The authors checked the average time of contact with information by source per day. People obtain information from family and friends most, followed by news media and government briefs. However, the time spent for collecting information through social media channels is relatively less. This suggests that people rely on the immediate environment and socially authorised formal sources for emergency information. Note that we do not consider the differences in accessibility among these sources here. Generally, people spend more time with friends and family than with healthcare professionals in their daily lives, and there are more opportunities for engaging with information about COVID-19 from the former.

Results of information perception and behaviour by personal characteristics

Figure 3 illustrates the results of information perception and behaviour by country. The bar shapes are different for country panels. Japanese do not actively share information with others, as 'transmission' scores are between 1.92 and 2.27 across the five sources of information; Americans are very active in communicating information, as the scores are between 2.77 and 3.33. Germans, with scores between 2.42 and 2.75, can be positioned between Japan and the

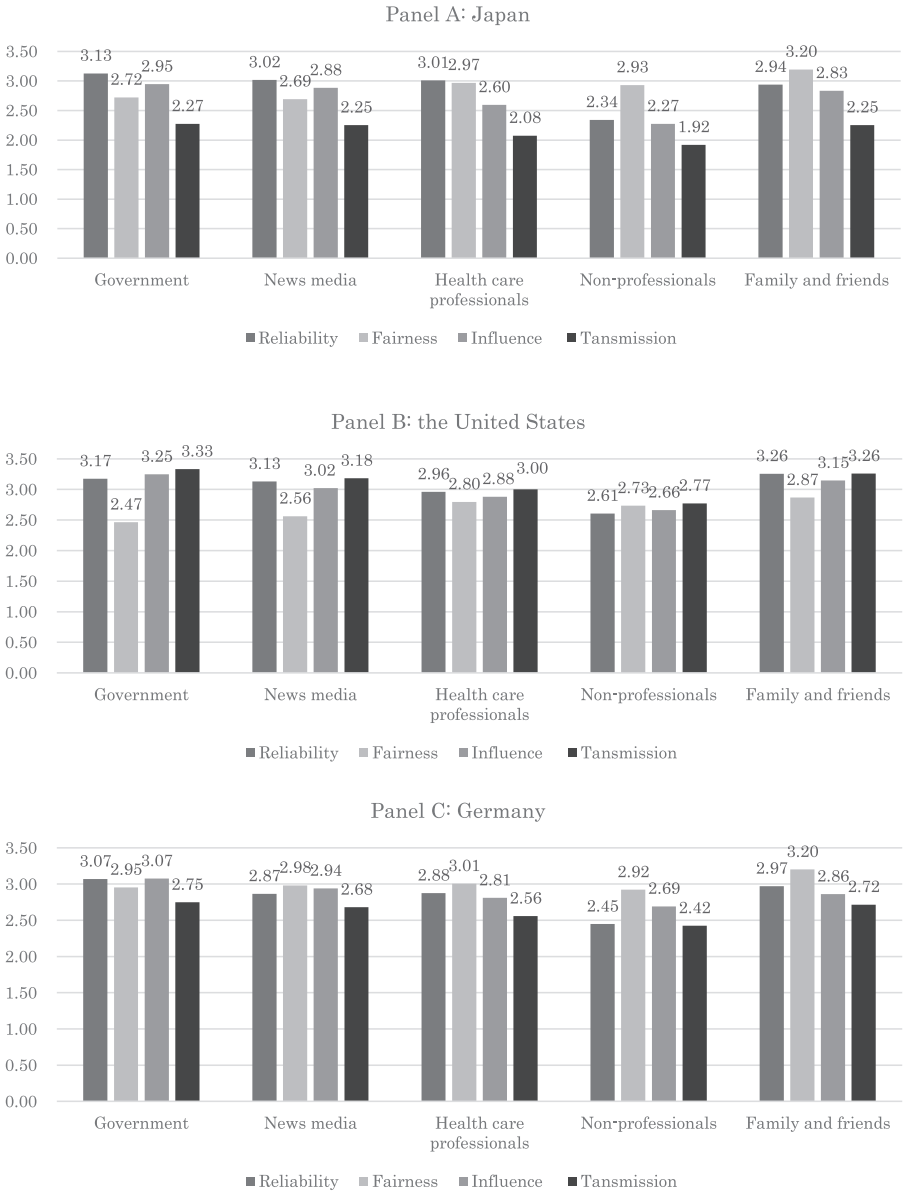

Figure 3. Information Perception/Behaviour by Country (5-point Likert Scale). Source: By authors

United States. The findings of this study align with Hall (1976), Hofstede (1984, 2011) and Hofstede *et al.* (2010), which describe the United States as a highly individualistic society and Japan as a high-context culture. However, the perceived fairness of information is generally low in the United States, as the 'fairness' scores are between 2.47-2.87, which is consistent with Pharr and Putnam (2000). By contrast, fairness is relatively high in Germany, as the scores were 2.92-3.20, and those of Japan were 2.69-3.20, falling between the United States and Germany. Although these results reveal diverging qualities of trust in these three countries, some common characteristics can be observed. That is, reliability in non-professional information was rated lowest, information from personal networks was considered relatively reliable and fair, and perception of public information communicated by the government and news media were very similar.

The authors checked the results by age category. As a result, it is revealed that while the perceived fairness seems to be low in the age groups 30-39 and 40-49 years, it is relatively high among the younger (20-29 years) and older aged groups (50-59 years and over 60 years). Despite the middle-aged group's low rating for fairness, they are most responsive regarding behavioural changes and diffuse the information actively. The results seem reasonable, considering that behavioural changes and information communication are especially important, as this age group has a major role in the country's economic activities. Given the significant social influence of this group, encouraging it to take actionable initiatives may facilitate promoting community level behavioural changes during emergencies. However, the low level of perceived information fairness in this group could obstruct this initiative, as their apprehension about the veracity of the information could impede them from taking actions. However, this issue can be mitigated by improving the level of fairness of the information. The influence and transmission of information by social media, tends to be low with advancing age. Moreover, the fact that people aged between 50-59 years and above 60 years are not responsive to the influence of overall information suggests that mere information delivery may not be sufficient to support behavioural changes in this group. In contrast, young people are relatively responsive to information. Especially, social media information has a certain impact on young people, while the influence of family and friends is generally large.

Next, the results were compared by family size: a family with a single member and a family comprising multiple people. It is revealed that the level of influence and transmission of information is clearly larger for the latter than the former. This may simply reflect the fact that people living alone have fewer opportunities for influence and information diffusion. Additionally, reliability of information posted on social media is typically lower for people living alone. However, the perceived fairness of information from healthcare professionals and family and friends is greater for these people.

Table 1 shows the relationship between the level of regional economic strength and information perception and behaviour by country. Level of regional economic strength is proxied by prefecture/state-level GDP. Relationship is expressed as correlation coefficients with regional GDP, information perception and behaviour. The values are interpreted, for instance, as the correlation between the reliability of information issued by the government and prefecture/state-level GDP in the United States is 0.189. Country differences clearly exist, as the coefficients of reliability, influence, and transmission showed a negative sign in Japan, while they showed a positive sign in the United States. This indicates that people living in economically developed regions perceived lower reliability and fairness of information and transmitted less information than people living in less developed areas in Japan, while the opposite is true for the United States. Greater influence and transmission in developed areas in the United States, despite the limited fairness of the information, may arise due to population density or the need to respond to the spread of infection in these areas. In the United States, the absolute values of the correlation coefficients for reliability, influence, and transmission are higher for information communicated by the government. Many of the coefficients in the United States show statistical significance, implying that

Table 1. Correlation Coefficients of Information Perception/Behaviour with Regional GDP

		Government	News media	Healthcare professionals	Non-professionals	Family and friends
Reliability	JP	-0.071	-0.111*	-0.096*	-0.098*	-0.087*
	US	0.189*	0.177*	0.165*	0.131*	0.138*
	DE	0.050	0.037	0.010	-0.025	-0.020
Fairness	JP	-0.088*	-0.077*	0.002	-0.07	-0.011
	US	-0.070	-0.114*	-0.078*	-0.050	-0.117*
	DE	-0.005	0.031	0.050	0.004	0.059
Influence	JP	-0.025	-0.107*	-0.05	-0.039	-0.101*
	US	0.155*	0.131*	0.147*	0.148*	0.119*
	DE	0.076*	0.077*	0.030	0.003	0.023
Transmission	JP	-0.084*	-0.090*	-0.047	-0.041	-0.061
	US	0.219*	0.158*	0.112*	0.130*	0.161*
	DE	0.065	0.052	0.02	0.012	0.050

(Note) * denotes significance at the 1% level.
Source: By authors

information perception and behaviour and regional economic strength are strongly related. In Germany, the results for influence and transmission are similar to the United States, but the results for reliability and fairness are mixed. The magnitudes of coefficients in Germany are generally lower than the other two countries, and the coefficients are not statistically significant, indicating that the relationship between information perception and behaviour and the level of regional economic strength is not strongly related in Germany. By contrast, the perceived fairness of information correlates negatively with GDP, with a few exceptions. This indicates that people living in more developed areas did not consider the pandemic information as fair.

Results of time of contact with information by personal characteristics

The results of contact time of pandemic information were compared by country. Japanese citizens spend less time, on average 2 to 8 minutes, to collect information about the pandemic. This result may relate to the fact that the influence and transmission of information are relatively low for Japanese citizens. Specifically, contact time with social media information, communicated by healthcare professionals and non-professionals, is low for Japanese citizens, indicating that they rely on government information, news media, and people in the immediate environment.

Conversely, people in the United States and Germany take a longer time to collect information, on average 10 to 16 minutes per day. Germans sought information mainly from the government, news media, and family and friends. In comparison, Americans pursued information from healthcare professionals and non-professionals as almost the same weights as the government and news media. The trend of information contact time is similar to fairness than reliability for American people, suggesting that information collection behaviour has a relationship with perceived fairness of information rather than reliability in the United States. However, this relationship is hardly observed in Japan and Germany. The common tendency between the United States and Germany is that family and friends are the most trusted sources of information.

Next, the relationship between the contact time of pandemic information and age category was examined. People aged 30-39 years take a longer time to collect information generally, probably because this age group has a strong incentive to collect pandemic information as they have a major role in the country's economic activities. Conversely, the tendency of people aged 40-49 years is different from other working-age populations, as their information collection

time from the government and news media is not as large as those in age groups 30-39 years and 50-59 years. This result is difficult to interpret with using the current data; therefore, it requires further investigation with more detailed data. Overall, the younger generation aged 20-29, 30-39, and 40-49 years tend to spare more time for collecting social media information than the older age group. However, people across all age groups, except 50-59 years, spare the longest time for collecting information from family and friends. People aged 50-59 years prefer to collecting information from news media.

The relationship between the contact time for collecting pandemic information was also examined by family size. Clearly, people living with their families spent more time for collecting information than people living alone. This is natural, considering that the impact of the infection can span across families if they live together; therefore, the impact of pandemic-related information is greater for these people. However, the time for collecting information from social media is briefer than that from government and news media sources, and time spent on collecting information from family and friends is longest among all sources is common for people living with their families and those living alone.

Results of Probit Regression on behaviours

Using the ordered probit model, the authors analysed whether influence and transmission relate to information perception and personal characteristics. Table 2 shows the estimation results, which include control variables for gender, age category, and country in all the models. For a reference, 'cooperation' is shown as the participant's subjective effectiveness of cooperation, which can be related to willingness to cooperate, and is measured by 'to what extent does a respondent think his/her abstaining from various activities can prevent the spread of COVID-19'. Explanatory variables are the average scores of information perception from five sources, denoted as 'Reliability' and 'Fairness,' average time of contact with information from five sources, ('Contact time'), importance of information speed ('Speed'), contact level of infection ('Infection experiences'), and individual characteristics ('Family size', 'Income', and 'Regional GDP'). Income is measured by 12 categories and family size is measured by 6 categories. 'Speed' is measured by examining the response patterns of respondents, that is, to what extent they consider the speed of information delivery as important compared to accuracy of information on a 5-point Likert scale. As the dependent variables are measured on a 5-point Likert scale, we used the ordered probit model. While an ordered probit regression assumes that unobserved factors of the behaviours have no correlations, we estimated the same model

Table 2. Results of Estimation based on Individual Behaviours

Dependent Variable	Cooperation		Influence		Transmission	
	Coeff.	(Std. err.)	Coeff.	(Std. err.)	Coeff.	(Std. err.)
Reliability	0.277***	(0.047)	0.323***	(0.050)	0.336***	(0.050)
Fairness	0.107**	(0.042)	0.022	(0.045)	-0.073*	(0.044)
Contact time	0.004	(0.003)	0.010***	(0.002)	0.016***	(0.002)
Speed	0.153***	(0.032)	0.300***	(0.032)	0.352***	(0.034)
Infection experiences	0.004	(0.017)	-0.024	(0.016)	-0.029*	(0.015)
Family size	0.022	(0.021)	0.081***	(0.021)	0.093***	(0.022)
Income	0.047***	(0.013)	0.037***	(0.013)	0.025*	(0.013)
Regional GDP	0.043	(0.028)	0.031	(0.027)	0.026	(0.026)
N	1521		1521		1521	
Pseudo R2	0.055		0.044		0.080	

(Note) ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: By authors

with multivariate ordered probit regression, which assumes that unobserved factors of the behaviours are correlated. The results do not largely differ between these two regressions except the coefficient of contact time in cooperation is significant in multivariate ordered probit regression.

The results in Table 2 suggest that when people consider information as reliable, they consider their cooperation by refraining from outdoor activities as effective, change their daily lifestyle as they adapt to new habits, and disseminate the information to others. This implies that information sources that are deemed highly reliable in Figure 2, such as governments and news media, are effective in preparing citizens during emergencies. However, it is also essential to make people believe that information is not being deliberately withheld or obscured, as fairness of information influences cooperation. Moreover, the significantly negative coefficient of fairness in the transmission suggests that, when people believe that the fairness of the information is low, they share the information with others more often. This implies that negative evaluation of information fairness has a greater influence than a positive assessment. In fact, during the COVID-19 pandemic, individuals who were sceptical about the information provided by established organisations expressed their feelings of distrust through various channels such as social media, word-of-mouth communication, and by publishing books. The positive coefficients of contact time of information indicate that when people exchange pandemic-related information, their attitudes for cooperation can be established, and they change their daily routines to the new situation and transmit the information more often. The importance of speed of information dissemination has positive coefficients for all three behaviours with marked statistical significance, suggesting that speedy information delivery can be effective for pandemic responses. Thus, information policies should secure information fairness by honest, frequent, and immediate disclosures to avoid social distrust of information.

Conclusions

This study shows individuals' response and perception of information provided by various agencies during the pandemic. Using survey data covering 1,572 individuals in Japan, Germany, and the United States, the following conclusions are derived. Information published by the government was considered more reliable than information from other sources, but less fair. Conversely, information provided by healthcare professionals is seen as relatively high in fairness. The perceived reliability of information given by family and friends is almost as high as that by provided by government and healthcare professionals, and the perceived fairness is highest. Moreover, people share information given by family and friends with others as actively as the information provided by government agencies and news media channels. Similarly, reliable updates from the government, news channels, and family and friends helped people make informed decisions about their daily routines during the pandemic, whereas social media did not create a similar awareness.

The above results differ by country, age, family size, and place of residence. For instance, country differences for information perception and responses show that while the Japanese do not actively disseminate information, Americans are proactive in transmitting information. At the same time, Germans are not as active as Americans in information transmission. The perceived fairness of such information is generally low in the United States and relatively high in Germany. Moreover, the perceived fairness seems to be low among middle-aged groups and relatively high among the young and elderly generations. Despite the low level of perceived fairness, middle-aged groups are responsive to such information, given their participation in the community's economic activities in society. The influence of information communicated via social media tends to be low with age. Differences by family size show that the level of influence and transmission of information are clearly significant for people living with their family than individuals living alone. Reliability of information from social media channels is lower among people living alone, while the perceived fairness of information from healthcare

professionals and family and friends is substantial among these people. Differences by place of residence show that reliability, influence, and transmission are negatively correlated with the level of regional economic strength in Japan but positively correlated in the United States, while the relationship is not strong in Germany.

This study has practical implications for future information delivery policies during an emergency. First, as most citizens rely on socially authorised formal sources and the immediate environment for emergency information, rather than social media, government information and word-of-mouth communication are critical. However, as perceived fairness of government information is not high, efforts must be made for securing such fairness. For instance, as our study shows that people perceive information from healthcare professionals as fair, the government can deliver information through an independent organisation or a committee comprising field professionals. The same implication can be derived from the result that negative evaluation of information fairness has a greater influence than a positive assessment on information transmission. Considering that bad news travels fast, policy makers must secure information fairness, although speedy information delivery enables effective communication. Follow-up information supplementation from field professionals could support this aim.

Second, information delivery methods should consider cultural and institutional differences across countries. In the United States, immediate, frequent, and rapid dissemination of information through influencers, particularly field experts, is likely to be well received, consistent with Hofstede's (1984, 2011) characterisation of the country as highly individualistic with short-term orientation. In Germany, press conferences by government officials and news media articles can be effective owing to citizens' high reliance on these sources. In Japan, where strong institutional trust in the government is evident, as demonstrated by Pharr and Putnam (2000), official announcements remain important. Although Japanese people do not actively disseminate information, the shared values of a high-context culture (Hall, 1976) suggest that extensive efforts to promote information distribution may be less necessary than in other countries.

Third, some incentive mechanisms targeting specific clusters for behavioural changes can be combined with information delivery policies. For instance, people between 50-59 years and over 60 years are not as responsive to information as those in other age groups. Economic incentives or some nudges can be combined with information provision. As our results show that communication with family has a significant impact, and that the middle-aged group is most active in behavioural change, advertising or campaigns encouraging this group to influence older family members could be helpful.

The study has some limitations. First, our assessments exclude differences in information disclosure characteristics among countries. Generally, a government's information disclosure policy depends on the country's political context, and quality of social media information is influenced by social stability. Therefore, the observed differences in reliability and fairness cannot be solely attributable to people's perception. Second, the costs of information collection are often not controlled among different information sources in our study. When people can access information easily, the time for collecting information is lower, and this affects the differences in information collection time among different sources. Information quality can also influence collection time. When the source of information is unreliable, people spend more time scrutinising the information. Detailed future assessments could control these factors. Third, our analyses have an explanatory power of at most 11 percent, indicating that personal behaviour could be affected by other factors. A model with a higher explanatory power should be used in future studies. Notwithstanding these limitations, our analysis highlights major contributions in that the results obtained here provide practical implications for future policymaking. As assessments considering the above issues are complex and challenging, they are left for future analysis.

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