WINPEC Working Paper Series No.E2202
June 2022

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June 27, 2022

Abstract

Given the criticism of the Japanese government-sponsored information despite Japan's relatively successful pandemic control, we designed a survey experiment to test how and when COVID-19 statistics and messages sponsored by the Japanese government influences people's risk perception, policy evaluation, behavioral intentions, and future pandemic expectations. On average, government-sponsored statistics and messages rarely induced intended reactions from the public and could even cause backlash. Institutional trust partially played a moderating role in these effects but only slightly. Combined with outcome measures' correlational analysis, the Japanese public was found to separate pandemic severity from government performance when forming attitudes and behaviors. This implication provides insights into the seeming disconnection between the pandemic state and government evaluation in Japan.

Keywords
COVID-19, government-sponsored information,
public opinion, Japan, survey experiment

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1 Introduction

The pandemic caused by the novel coronavirus (COVID-19) has had a significant impact on people worldwide. Since the medical details of infectious diseases might be beyond the general public's comprehension, governments play an essential role in providing people with the relevant information. However, it is not entirely clear if the government-sponsored information on COVID-19 has desired effect on public perceptions, attitudes, and behaviors. In fact, in the United States, political preferences are claimed to influence the perception and effectiveness of information related to COVID-19 (e.g., Barrios and Hochberg, 2020; Painter and Qiu, 2020). On the other hand, to our knowledge, relevant issues are rarely assessed in contexts outside the United States.

In this study, we focus on Japan, which has been regarded as relatively successful in containing the spread of COVID-19. Nevertheless, there have also been widespread suspicions and criticisms of the effectiveness of the measures taken by the Japanese government. Thus, it remains unclear whether the national government played any role in influencing the perceptions and behaviors of its citizens. Using a survey experiment in Japan, we explored the determinants of perceptions, attitudes, and behavioral intentions relevant to COVID-19 after exposure to official statistics and messages related to COVID-19 infections and deaths. The results offer new insights into the reliability and effectiveness of government-sponsored COVID-19 related information.

In addition to testing the effect of government-sponsored information, we assess the roles played by the institutional trust. For the information provided to have the desired effect, apart from its actual accuracy, the institution sending the information should be highly trusted by the public. More specifically, we compare the effect of government-sponsored information with that of information sponsored by the World Health Organization (WHO) and explore if trust in these institutions plays any role. Furthermore, we conducted a supplemental analysis to explore the correlations between political and demographic factors and COVID-19 related outcomes.

The remaining article is organized as follows. The following section discusses the current states and implications of government-sponsored COVID-19 information in Japan.

The third section describes our survey experiment design. The fourth section explains the obtained analytical results, and the last section summarizes and discusses findings and implications.

2 Government-Sponsored COVID-19 Information in Japan

COVID-19 has significantly and adversely affected all parts of the world, and a large number of casualties have been reported. According to such reports, the situation in Japan has been handled relatively well compared with many European and North American countries. At the end of 2021, 13,768 cases were reported per 1 million people in Japan. This number is 152nd in the world, which is lower than any European and North American country. For example, the same statistic is 186,324 in the UK (11th in the world), 165,476 in the United States (18th), and 56,028 in Canada (107th). The only OECD countries with this statistic lower than Japan are South Korea (12,289, 156th) and New Zealand (2,822, 184th).[1]

Although the official statistics imply that Japan is coping with the pandemic fairly well, the media, opposition parties, and medical experts in Japan have been criticizing the government, saying that the measures to combat COVID-19 taken by the government are weak and misleading. One of the widely shared concerns is the suspected underreporting of cases due to insufficient testing. Such insufficiency is often reflected in the positivity ratio in tests. WHO recommends that the positivity ratio should not exceed 5%, claiming that a higher ratio may imply insufficient detection of positive cases. Most European and American countries maintained this ratio below 10% through 2021. In Japan, however, the ratio occasionally rose to 20% during 2021.[2]

Apart from limiting the number of tests, there are also various other opportunities where the government can manipulate the seemingly objective information about the

[1]Data source: https://www.worldometers.info/coronavirus/. Last accessed on December 31, 2021, 07:13 GMT.

[2]Data source: https://ourworldindata.org/coronavirus-testing. Last accessed on November 14, 2021.

pandemic. Although more obvious practices of manipulation are observed in autocratic countries (Adiguzel, Cansunar and Corekcioglu, 2020; Kapoor et al., 2020; Kilani, 2021; Annaka, 2021), democracies are no exceptions (Adiguzel, Cansunar and Corekcioglu, 2020). For example, Andrew Cuomo, the former governor of New York, was found to conceal the actual number of deaths to reduce criticisms against him.[3] Additionally, in the United States, Iuliano et al. (2021) analyze excess mortality data and argued that there were a considerable number of unrecognized COVID-19 deaths.

In Japan, the exact extent of bias in reported COVID-19 statistics is unknown, and it is *not* the intention of this study to provide the accurate measurement of such bias. Instead, this study is interested in the effect of government-sponsored statistics and related messages, if any, on people's perceptions, attitudes, and behavioral intentions related to COVID-19. Watanabe and Yabu (2020, 2021) used smartphone location data and suggested that Japanese people tend to stay more at home when there is an increase in the reported number of infections. However, such observational evidence has at least two limitations. First, reliance on observational data makes it difficult to isolate the causal effect of government-sponsored information. Second, the narrow focus on stay-home behavior may not be able to include the breadth of perceptions, attitudes, and behaviors related to COVID-19.

To address the above gap in knowledge, we designed a survey experiment to assess the causal effect of government-sponsored statistics and messages on the Japanese public. Additionally, to capture the breadth of COVID-19 related outcomes, we measured COVID-19 related risk perception, policy evaluations, behavioral intentions, and expectations for future improvement (Azlan et al., 2020; Honarvar et al., 2020; Maheshwari et al., 2020; Ngwewondo et al., 2020; Pal et al., 2020; Paul et al., 2020; Reuben et al., 2021; Rios-González, 2020; Yue et al., 2021; Zhong et al., 2020). The following section describes our experimental design.

[3]Data source: https://www.cnbc.com/2021/08/25/gov-hochul-acknowledges-more-new-york-covid-deaths-than-andrew-cuomo-counted.html. Last accessed on November 14, 2021.

3 Experimental Design

To assess how the Japanese public reacts to government-sponsored COVID-19 information, we designed a survey experiment. The survey was fielded between March 16 and 18, 2021. The time period was between the third (late November 2020 to early February 2021) and the fourth waves (late March to mid-June 2021) of infections in Japan, when the situation was relatively well controlled. We recruited 2,188 Japanese respondents aged 18 to 79 years from the monitor pool of an online survey company, *Rakuten Insight*.[4] The gender and age distributions of respondents were adjusted to correspond with nationally representative distributions. We used *Qualtrics* to ask questions and record de-identified answers.

3.1 Guessing COVID-19 Infections and Deaths

Before assigning experimental treatments, we asked questions to gauge the prior beliefs of respondents about the severity of the pandemic. Specifically, all respondents were asked to guess how many people had been infected by COVID-19 in Japan, as follows:

> *Approximately how many people do you think have been infected by the novel coronavirus in Japan? There is no need to search. Just give your best guess.*

We then also asked how many people the participants thought had died of COVID-19 by replacing "infected by" with "died of." For both of the questions, if respondents did not provide specific numbers, we further probed them to choose a response to a question with multiple choices:

> *Then, if you had to choose from the following options, how many people do you think have been infected by (died of) the novel coronavirus in Japan? Tell us which one is the closest to your impression.*
>
> - *Less than 1,000 (100)*

[4] A total of 252 respondents who failed the satisficer question were excluded from the analysis, reducing the number of valid respondents down to 1936. The satisficer question is as follows: "In this study, we analyze how respondents read questions and choose answers as important data. Please choose the fourth response option in this question."

- *1,000 (100) or more, less than 10,000 (1,000)*
- *10,000 (1,000) or more, less than 100,000 (10,000)*
- *100,000 (10,000) or more, less than 200,000 (20,000)*
- *200,000 (20,000) or more, less than 500,000 (50,000)*
- *500,000 (50,000) or more, less than 1,000,000 (100,000)*
- *1,000,000 (100,000) or more*

For the analysis, the above guesses were rescaled and combined to capture the perceptions of pandemic severity among respondents. First, for those who did not provide exact numbers, we replaced their missing guesses with the mid-point of the category they chose in response to the multiple-choice probe question.[5] Second, we took a logarithm of guesses, since the distributions of guesses was highly skewed to the right.[6] Third, we standardized the logged guesses and average infections and deaths. Fourth, we centered the score using the officially reported number of infections (ranges between 448,531 and 450,648 depending on the date and time of the survey) and deaths (ranges between 8,630 and 8,718). We call this outcome measure *severity guess*.

Figure 1 shows the distribution of severity guess scores. The score takes the value of 0 where it represents the reported reality, and a unit increase corresponds to a standard deviation increase in logged guesses. The figure clarifies that there are five times more underestimators of reported reality than overestimators. Here, we should note that previous discussions have suggested widespread suspicions on the under-reporting of COVID-19 severity in Japan. However, interestingly, in our dataset, the supermajority of respondents believe in a lower-than-reported number of COVID-19 infections and deaths. In fact, our overall median respondent predicted the number of infections to be 100,000 where the reported reality was approximately 450,000 and predicted the number of deaths to be 3,000 where the reported reality was approximately 8,700. For ease of

[5]Inclusion of the multiple-choice probe responses does not have a major impact on the final measurement. For both infections and deaths, probed answers were used for less than 5% of respondents. Additionally, there are no statistically significant differences between the average values of initial and probed responses ($p > 0.2$ for both infections and deaths).

[6]In the preregistration, we planned to use the raw guess. However, we believe this change is justified: The raw distribution was severely skewed and results were insensible without logarithmic transformation.

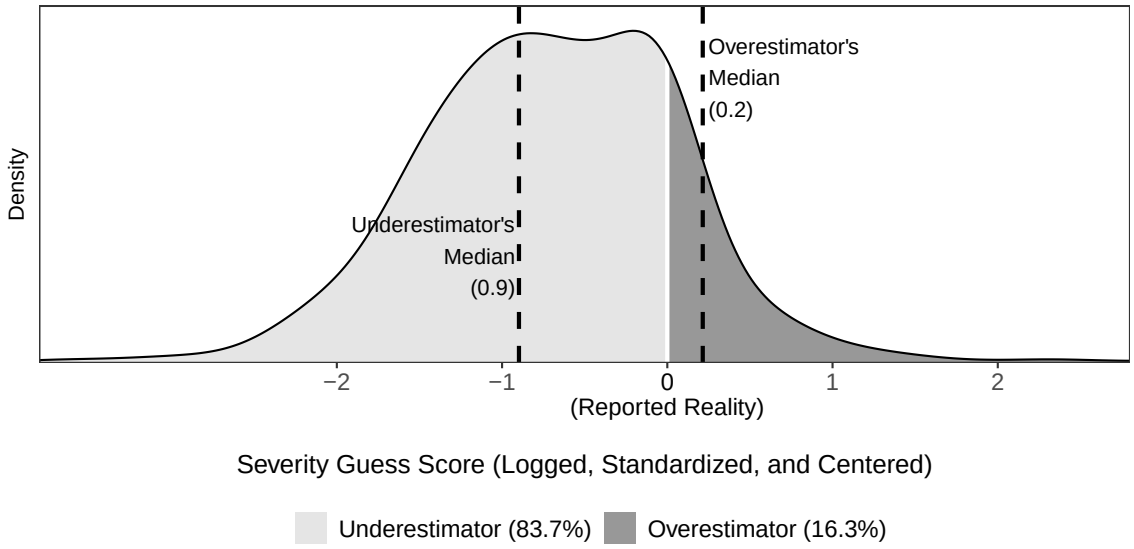

Figure 1: The distribution of severity guesses of COVID-19 infections and deaths

later interpretation, we split respondents into *underestimator* (scores below the reported reality, 83.7%), and *overestimator* (scores above the reported reality, 16.3%) groups. In the analysis section, we assess the effect of experimental treatments for the median of each group.

3.2 Statistics and Message Treatments

After they guessed the number of COVID-19 infections and deaths, we randomly exposed respondents to one of the seven statements. First, in the control condition (i.e., **Condition 0**), respondents only see a statement that repeats their guesses:

> *You guessed that approximately [GUESSED INFECTIONS] people are infected by and [GUESSED DEATHS] people have died of COVID-19.*

The first type of treatment involves exposing the respondent to the official COVID-19 statistics. In addition to the control text, in **Condition 1**, respondents are exposed to the statistics allegedly from the Ministry of Health, Labour and Welfare (MHLW) of the Japanese government:[7]

[7]The inserted latest numbers of infections and deaths were extracted from the special website of NHK (Japan Broadcasting Corporation) using the following free API from apify.com: https://apify.com/lukass/covid-jap. These numbers may or may not precisely match the latest numbers published by the Japanese government or the WHO, but the differences should be negligible. We use these numbers to standardize the "real numbers" presented to the respondents.

According to ***official statistics published by the Ministry of Health, Labour and Welfare*** *of Japan on the novel coronavirus,* ***[REPORTED INFECTIONS] infections and [REPORTED DEATHS] deaths have been reported in Japan****.*

The second type of treatment is introduction to a comforting message from political leaders. Again, in addition to the control text, in **Condition 2**, respondents are exposed to a message from the Prime Minister of Japan:

Based on the reported statistics of COVID-19, ***the Prime Minister of Japan*** *suggested that the pandemic situation in Japan has been relatively calm compared to countries in North America and Europe.*

Lastly, the combination of COVID-19 statistics and the comforting message are provided in **Condition 3**, as follows:

According to ***official statistics published by [the Ministry of Health, Labour and Welfare*** *of Japan /* ***World Health Organization (WHO)****],* ***[REPORTED INFECTIONS] infections*** *and* ***[REPORTED DEATHS] deaths*** *have reported in Japan. [****The Prime Minister of Japan / The director-general of WHO****] suggested that the pandemic situation in Japan has been relatively calm compared to countries in North America and Europe.*

3.3 Information Source: Japanese Government versus WHO

We can assess the effects of the reported statistics and messages through Conditions 1, 2, and 3. However, with only these conditions, it is difficult to examine if the source of the information, i.e., the Japanese government, plays any role. In other words, we do not know if the information matters because it is sponsored by the Japanese government or just because of the content. In Conditions 4, 5, and 6, we replace the Japanese government with the WHO as the information source. In **condition 4**, respondents are exposed to the same reported numbers as Condition 1, but these numbers are allegedly from the

WHO. Specifically, we replaced "***the Ministry of Health, Labour and Welfare*** *of Japan*" with "***World Health Organization (WHO)***" in the above statement. **Condition 5** uses the same message as Condition 2, but it is from "***the director-general of World Health Organization (WHO)***" instead of "***the Prime Minister of Japan***." **Condition 6** parallels Condition 3 with WHO being replaced as the source..

We expect WHO to be a feasible and meaningful alternative to the Japanese government in providing COVID-19 statistics and messages. We have at least two rationales. First, the two institutions do not always have the same reputation.[8] To capture potentially different institutional reputations, we separately asked survey respondents the trust toward the Japanese Prime Minister, the MHLW of Japan, and the WHO. Then, we create binary measures of *government trust* (trusting Prime Minister or the MHLW)[9] and *WHO trust*. The two measures are positively correlated, but nearly 40% of the respondents trust only one of the two institutions. Second, while the WHO relies on the Japanese government to gauge the state of the pandemic in the country, not everyone recognizes this reality. In fact, in our survey, nearly half (44.3%) of the respondents do not realize that the WHO is an international organization dependent on the information provided by national governments. This situation gives us reason to assume that two alternative information sources, i.e., the Japanese government and the WHO, can have different meanings for the Japanese public.

3.4 Hypotheses

After being exposed (or not being exposed) to the randomized statements, respondents were asked to answer conventional questions on perceptions of and attitudinal and behavioral responses to COVID-19: (1) The risk perception of COVID-19 (*risk perception*); (2) Evaluations of the government response to COVID-19 (*policy evaluation*); (3) Be-

[8]According to the nationally representative survey conducted by *Yomiuri Shimbun* during March/April 2021, the Japanese government and the WHO were equally likely to be trusted for their responses to COVID-19 (https://www.yomiuri.co.jp/election/yoron-chosa/20210429-OYT1T50204/). Around 50% of respondents trusted the each of institutions, thus the level of trust was not too high and not too low.

[9]In the preregistration, we planned to only use the trust for Prime Minister. However, since the MHLW is clearly presented as a sponsor of statistics treatment, we believe it is justifiable to incorporate MHLW trust.

havioral intentions to prevent the spread of COVID-19 in the next six months (*health behavior*); and (4) The prediction of future improvement in COVID-19 related situations (*future improvement*) (see Appendix for detailed wordings).[10] Other than for (1), multiple questions were asked in each category, and we created composite measures by taking an average. All four measures were rescaled to the 0-1 range to make interpretations easier.

Regarding the exposure to statistics information correction treatment, we expect that, among underestimators (overestimators), the concern for COVID-19 would rise (diminish) following the exposure. Then, among the outcome measures, risk perception and health behavior should theoretically be positively related to the concern for COVID-19, whereas policy evaluation and future improvement should be negatively related. Therefore, we formulated the following hypothesis:

> **Hypothesis 1**: Among underestimators, the scores of risk perception and health behavior will increase and those of policy evaluation and future improvement will decrease following exposure to published statistics. Among overestimators, the scores of risk perception and health behavior will decrease and those of policy evaluation and future improvement will increase following exposure to published statistics.

Regarding the comforting message treatment, we expected the exposure to lower the concern for COVID-19 consistently. Therefore, we formulated the following hypothesis:

> **Hypothesis 2**: The scores of risk perception and health behavior will decrease and those of policy evaluation and future improvement will increase following the exposure to the comforting message.

Lastly, as explained above, we have two different (alleged) sources of information, i.e., the Japanese government and the WHO, for both the statistics and the message. Here, we expect that the level of trust in each institution may moderate sizes of treatment effect. As a result, we formulated the following hypothesis:

[10]The risk perception question was always asked first, and the future improvement questions were always asked last. The order of policy evaluation and health behavior questions was randomized.

Hypothesis 3: The reactions to the treatment will be conditioned by the perceived trustworthiness of the information source (i.e., the Japanese government and the WHO).

4 Analysis

Before starting the assessment of experimental treatments, we analyze the potential correlates of outcome measures to obtain a sense of the dataset. This analysis first includes our main variables of interest, i.e., severity guess, government trust, and WHO trust. Then, we examine political knowledge (aggregated score of ten factual test questions about politics, rescaled to 0-1 range) and infections experience (dummy variable that takes a value of one if the respondent knows anyone who has been infected personally or suspect themselves of having or have had the infection; zero otherwise). More knowledgeable individuals may act or form opinions differently than those less who are knowledgeable. We focus on political knowledge here, since most of the information relevant to COVID-19 comes from political sources. Similarly, the experience of infections (suspecting or knowing) would raise concern and awareness for COVID-19. We also consider demographic variables: gender, age, education, income, employment, and industry (service). The last variable, service worker, is included because the service industry is most severely affected by COVID-19. We also consider the standardized date of the interview to see if the interview timing is relevant.

Table 1 presents the results of the standard ordinary least squares (OLS) regression analysis with robust standard errors. We use the pooled dataset of all experimental conditions. While we cannot assume that the relationships found here are causal, the findings help characterize the COVID-19 related perceptions, attitudes, and behavioral intentions of the Japanese public. First, we observe that severity guess has a highly statistically significant positive relationship ($p < 0.001$) with risk perception and health behavior. This result is expected since these two outcomes are more directly relevant to the state of the COVID-19 pandemic. On the other hand, severity guess has weaker rela-

Table 1: Correlates of COVID-19 related risk perception, policy evaluation, health behavior, and future improvement

	Risk Perception	Policy Evaluation	Health Behavior	Future Improvement
Severity Guess (Logged, by 1SD)	0.031***	0.002	0.017***	0.010†
	(0.008)	(0.005)	(0.004)	(0.006)
Government Trust (Min. to Max.)	−0.019	0.161***	−0.002	0.096***
	(0.014)	(0.008)	(0.006)	(0.010)
WHO Trust (Min. to Max.)	0.017	0.014†	−0.004	0.006
	(0.014)	(0.008)	(0.006)	(0.010)
Political Knowledge (Min. to Max.)	−0.035	−0.020	0.031*	−0.042†
	(0.029)	(0.018)	(0.012)	(0.023)
Infections Experience (Dummy)	0.025	−0.013	0.001	−0.001
	(0.017)	(0.010)	(0.007)	(0.013)
Gender (Female)	0.055***	0.010	0.056***	−0.032**
	(0.015)	(0.009)	(0.006)	(0.011)
Age (by 10 years)	0.023***	0.003	0.009***	0.013***
	(0.005)	(0.003)	(0.002)	(0.004)
Education (Min. to Max.)	0.013	−0.036*	−0.003	−0.025
	(0.025)	(0.015)	(0.010)	(0.018)
Income (Min. to Max.)	0.022	0.013	0.044***	0.001
	(0.030)	(0.018)	(0.013)	(0.024)
Income (Non-Response)	0.026	−0.019	0.028***	−0.036*
	(0.021)	(0.013)	(0.008)	(0.016)
Unemployed (Dummy)	0.008	−0.018†	0.007	0.001
	(0.017)	(0.010)	(0.007)	(0.013)
Service Worker (Dummy)	−0.011	−0.010	0.007	0.010
	(0.016)	(0.009)	(0.007)	(0.012)
Date of Interview (by 1SD)	0.033	−0.006	0.006	−0.007
	(0.024)	(0.014)	(0.010)	(0.018)
(Intercept)	0.500***	0.371***	0.650***	0.531***
	(0.037)	(0.022)	(0.016)	(0.028)
R^2	0.040	0.207	0.095	0.066
Adj. R^2	0.033	0.201	0.088	0.059
Num. obs.	1819	1787	1795	1798
RMSE	0.281	0.166	0.118	0.213

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$

tionships with policy evaluations and future improvement. Furthermore, the coefficients are positive (not negative) and marginally significant ($p < 0.1$) for the future improvement outcome. This result is slightly surprising: the perception of pandemic severity does not have a strong connection (and, if any, a positive connection) with COVID-19 related policy evaluations and future improvement.

In contrast to severity guess, the Japanese government trust variable has positive and statistically significant relationships only with policy evaluations and future improvement. Those who believe the government do not necessarily have a lower risk perception or weaker intentions to follow COVID-19 related behavioral guidelines (while the sign of the coefficients are consistent with this expectation). The coefficients of WHO trust for policy evaluations and future improvement are also positive but are much smaller and

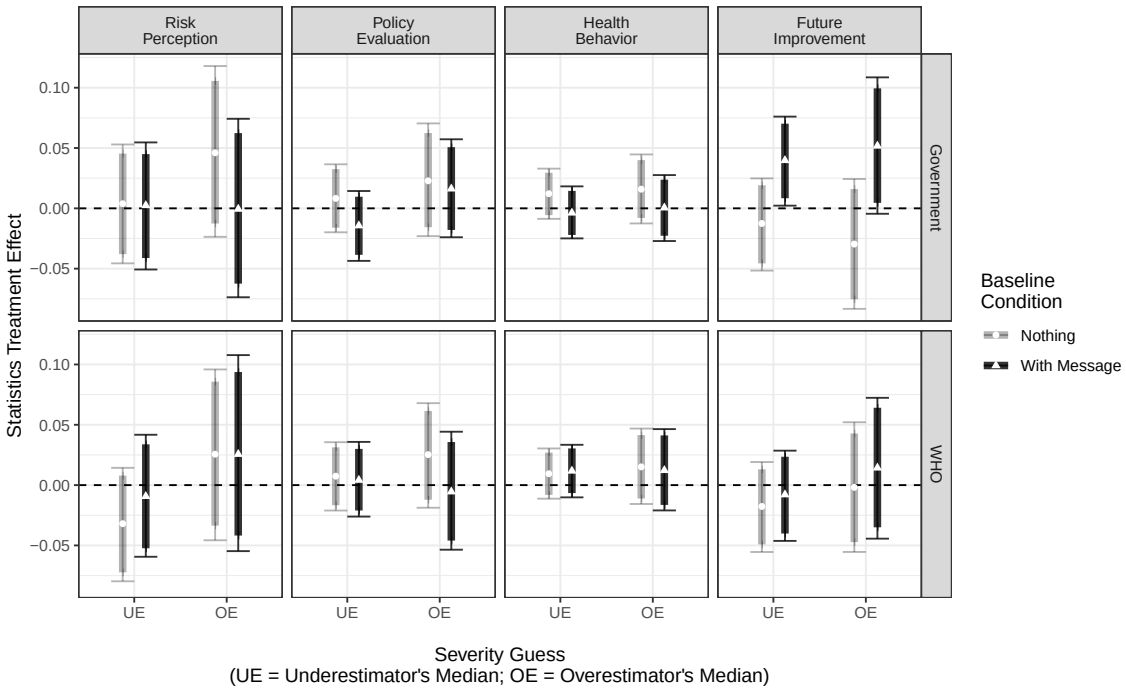

Figure 2: The effect of statistics information correction treatment on COVID-19 related risk perception, policy evaluation, health behavior, and future improvement

not highly statistically significant than those of government trust. This pattern makes sense since the WHO has less to do with domestic policies relevant to COVID-19.

For other variables, we see that more knowledgeable respondents have higher health behavior intentions ($p < 0.001$) and somewhat more pessimistic views about the future of the pandemic ($p < 0.1$). On the other hand, the experience of COVID-19 infections does not have strong connections with our outcome measures. While the signs of the coefficient are consistent with our expectations (positive for risk perception and future improvement, negative for policy evaluation and health behavior), all of them are not statistically significant ($p > 0.1$). Women and more elderly similarly have higher risk perception and health behavior intentions. On the other hand, women have lower, and older people have higher expectations for future improvement. More educated and unemployed people have lower policy evaluations, wealthier people have higher health behavior intentions.

4.1 Statistics Treatment Effects

In this subsection, we analyze the effect of statistics treatments. We estimate similar regression models as presented in Table 1 but also include dummy variables for the

treatment conditions. Hypothesis 1 implies that the initial guess of pandemic severity conditions treatment effects. Therefore, we also ensure that all treatment dummies are interacted with severity guess. The resulting regression table is complex; thus, it is included in the Online Appendix. Here, we instead visualize each treatment effect of interest with 95% confidence interval using the Monte Carlo simulation.[11]

Figure 2 presents the results relevant to Hypothesis 1. Each panel contains a point estimate (white point), 90% confidence interval (thick vertical line), and 95% confidence interval (thin vertical line) of the difference between the condition with or without statistics treatment. Positive estimates indicate an increase in outcome values, and negative estimates indicate a decrease. In top panels, statistics are sponsored by the Japanese government. Circle points and gray lines indicate the comparison between the statistics-only condition (Condition 1) and control condition (Condition 0); triangle points and black lines indicate the comparison between statistics and message condition (Condition 3) and message-only condition (Condition 2). In the bottom panels, statistics are sponsored by the WHO. Similarly, circle points and gray lines indicate the comparison between the statistics-only condition (Condition 4) and control condition (Condition 0); triangle points and black lines indicate the comparison between statistics and the message condition (Condition 6) and message-only condition (Condition 5). Finally, all treatment effects are estimated for underestimator's median (UE) and overestimator's median (OE) to see if there is any conditional effect.

In general, the results presented in Figure 2 indicate that the statistics treatment rarely has any effect on the risk perception, policy evaluation, health behavior, or future improvement. We found statistically significant effects ($p < 0.1$) only for government-sponsored statistics treatment when message treatment fixed at the baseline (triangle points and black lines in the top rightmost panel). However, we found no sign of the effect conditioned by severity guess. The effect stays positive for both underestimators and overestimators. In sum, we found no evidence to support Hypothesis 1.

[11] We regenerated coefficients 5000 times using multivariate normal distribution and estimate the size of treatment effect each time. Then, we extracted the mean, and the 2.5, 5, 95, and 97.5 percentiles of the exported values.

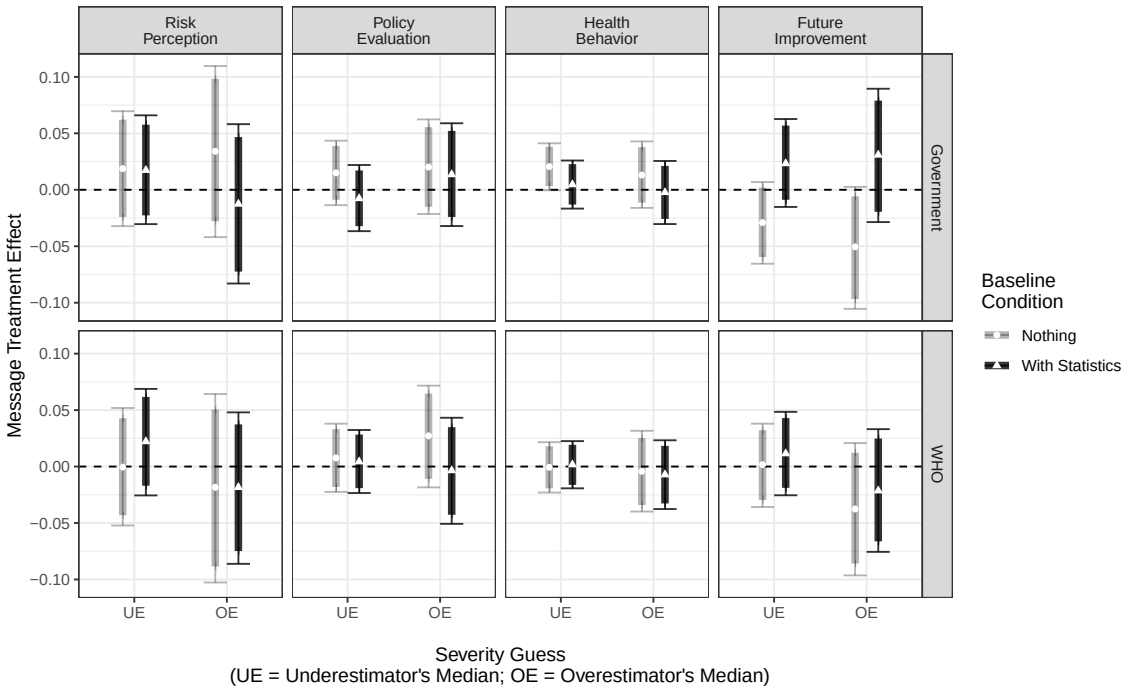

Figure 3: The effect of comforting message treatment on COVID-19 related risk perception, policy evaluation, health behavior, and future improvement

4.2 Comforting Message Treatment Effects

To assess Hypothesis 2, the results that parallel Figure 2 are presented in Figure 3. Instead of statistics treatment, here we focus on the difference in outcome values between conditions with or without the comforting message treatment. In top panels, messages are sponsored by the Japanese government. Circle points and gray lines indicate the comparison between the message-only condition (Condition 2) and control condition (Condition 0); triangle points and black lines indicate the comparison between statistics and the message condition (Condition 3) and the statistics-only condition (Condition 1). In the bottom panels, messages are sponsored by the WHO. Similarly, circle points and gray lines indicate the comparison between the message-only condition (Condition 5) and control condition (Condition 0); triangle points and black lines indicate the comparison between statistics and the message condition (Condition 6) and the statistics-only condition (Condition 4).

Message treatment, again, rarely induces any reactions from the Japanese public. The only marginally significant treatment effects are found for government-sponsored

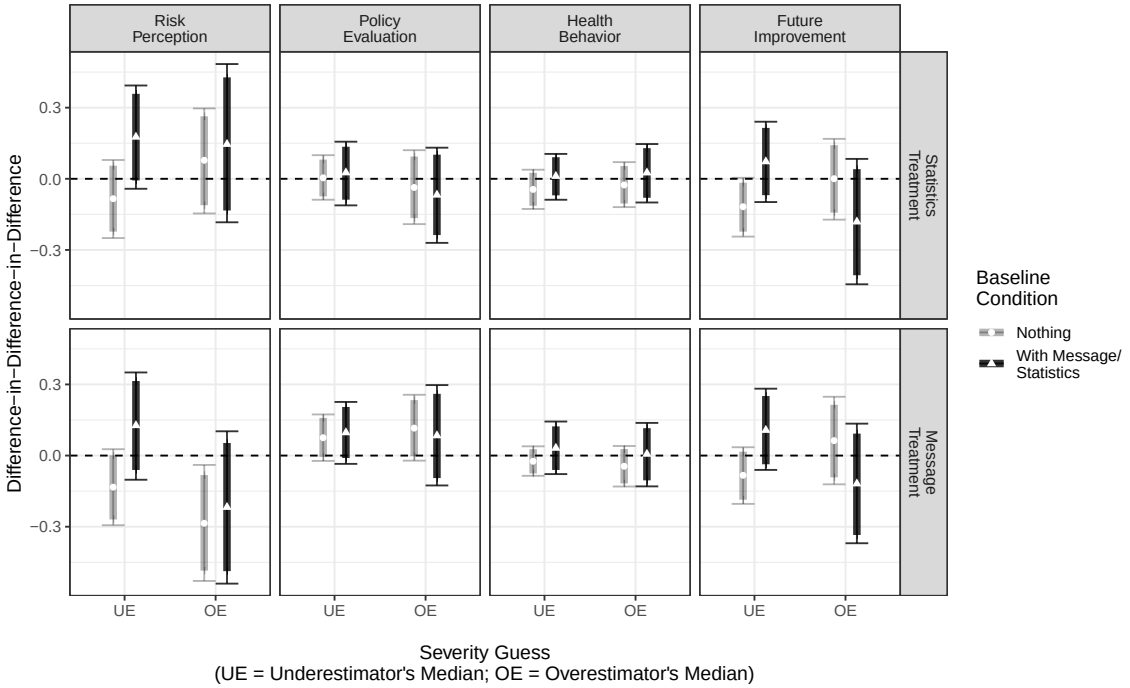

Figure 4: Difference between effects of government-sponsored and WHO-sponsored treatments on COVID-19 related risk perception, policy evaluation, health behavior, and future improvement

messages, for health behavior and future improvement under the comparison between the message-only and control conditions (circle points and gray lines). Furthermore, the effects are positive for health behavior (increased intention) and negative for future improvement (decreased expectation). These patterns imply that the government-sponsored comforting message, if any, causes *backlash* from the Japanese public. Therefore, we find some evidence that directly contradicts our expectations from Hypothesis 2.

4.3 Moderation by Institutional Trusts

To assess Hypothesis 3, we further estimate OLS regression models that interact treatment conditions with severity guess and government trust or WHO trust. Again, since the regression table is complex, detailed coefficients are presented in the Online Appendix. In Figure 4, we plot a simulated difference-in-difference-in-difference (DIDID) estimate to directly visualize quantities relevant to Hypothesis 3. Specifically, we first calculate the difference in treatment effects between government-sponsored and WHO-sponsored treatment through Monte Carlo simulation (difference-in-difference or DID estimate).

The DID estimate is positive if the government-sponsored treatment effect is higher than the WHO-sponsored treatment effect and negative otherwise. We calculate this estimate for *government truster* (hypothetical individual scoring 1 for government trust, 0 for WHO trust) and *WHO truster* (hypothetical individual scoring 1 for WHO trust, 0 for government trust). The final DIDID estimate is the difference in DID estimates between government and WHO trusters. Therefore, the higher the DIDID estimate, the larger the advantage government trusters have over WHO trusters in government-sponsored treatment effect over WHO-sponsored treatment effect.

If evidence is consistent with Hypothesis 3, we should see the following sets of DIDID estimates. For statistics treatment, we should see positive (negative) estimates for risk perception and health behavior and negative (positive) estimates for policy evaluation and future improvement among underestimators (overestimators). For comforting message treatment, we should see a negative estimate for risk perception and health behavior and positive estimates for policy evaluation and future improvement. In Figure 4, top panels indicate the results for statistics treatment and bottom panels present the results for message treatment.

For statistics treatment, we cannot see consistent patterns and reject the null hypothesis for most DIDID estimates. The only marginally significant result ($p < 0.1$) consistent with the hypothesis is for future improvement among underestimators, for the comparison between the control and statistics-only conditions (the leftmost circle/gray estimate in the top rightmost panel). Government trusting underestimators have more reduced future expectations than WHO trusting underestimators in response to government-sponsored statistics compared to WHO-sponsored statistics.

For comforting message treatment, DIDID estimates for risk perception outcome are negative and marginally significant for both underestimators and overestimators when the comparison is between the control and message only conditions (the bottom leftmost panel). This result is consistent with Hypothesis 3: Government trusters have more reduced risk perception than WHO trusters in response to government-sponsored than WHO-sponsored comforting messages. A similar tendency persists for the comparison

between statistics-only and statistics plus message conditions, particularly among over-estimators (while the estimate is statistically insignificant). DIDID estimates for policy evaluation outcomes are all positive, consistent with Hypothesis 3, but not statistically significant. There are neither consistent nor statistically significant patterns for other outcome measures.

5 Discussion

In this article, we have assessed the role of government-sponsored statistics and messages on public perceptions, attitudes, and behavioral intentions related to COVID-19 in Japan during March 2021. The finding suggests that government-sponsored information rarely induces significant reactions from the public. Even in case of any such reaction, the average effect of information is inconsistent with its intention. Exposure to government-sponsored statistics combined with a comforting message may induce positive views about the future improvement of the pandemic, regardless of the level of initial severity guess. Exposure to the comforting message from the Japanese Prime Minister may lead to backlash from the public. They may become more cautious about their behaviors and have pessimistic views about the future of the pandemic. Further investigation revealed some weak evidence that the level of institutional trust partially moderates these (null) effects. Those who trust the Japanese government (and do not trust WHO) react to the government-sponsored information more in the intended direction than those who do not trust the Japanese government (and trust the WHO).

While not the main focus of the study, supplemental correlational analyses reveal some interesting patterns. First, on average, our sample of Japanese adults underestimates the reported reality of pandemic severity (i.e., number of infections and deaths). This pattern is a little surprising since (potentially) underreporting of actual pandemic severity is supposed to be more widespread in Japanese society, rather than overreporting. Second, we find that the estimate of infections and deaths is significantly related only to risk perception and health behavior and not to policy evaluation or future expectation. We

believe this result partially contributes to our treatments' weak/inconsistent results for the latter two outcome measures. Our treatments attempt to influence the perception of pandemic severity, but such perception may not have a theoretically expected relationship with our outcome measures. Third, we find that trust in the Japanese government only influences policy evaluations and future expectations. Its influence does not spill over to risk perception and health behavior.

Our findings generally imply the weak effect (and potential backlash) of government-sponsored COVID-19 information in Japan. We even see a pattern of a backlash whereby people increase their caution about COVID-19 in response to positive messages from the government. Furthermore, correlational analysis implies that risk perception and health behavior tend to have different determinants compared to policy evaluation and future expectation. These patterns, combined with the experiment's null results, imply that the Japanese public may separate pandemic severity from the government policy performance. Therefore, the lower perceived severity of the pandemic does not necessarily lead to a positive evaluation of Japanese government policies (and vice versa). This implication is consistent in ways with the conventional understandings of the handling of the pandemic in Japan: people mainly act on their own to prevent the spread of the pandemic and not necessarily in reaction to the government-sponsored information or messages.

Our study design has some limitations. First, our information treatments may not be strong enough to induce significant reactions. Our treatments focus on influencing varieties of outcomes related to COVID-19 through the perception of pandemic severity. However, as already stated, the perception of pandemic severity itself might not be playing a substantial role in forming COVID-19 related attitudinal and behavioral outcomes. Second, our experimental design does not intend to gauge the effect of the "stay-at-home" message sponsored by the government. Instead, we focus on the opposite direction: To see if people's COVID-19 concerns reduce in response to positive messages from the government. Third, the COVID-19 pandemic is highly volatile and undoubtedly still progressing. The current finding represents a cross-sectional picture in Japan during March 2021, but how much it can be generalized to other time points is unclear. COVID-

19 related attitudes and behaviors among the Japanese public remain understudied. We hope that more studies in the near future will attempt to understand this potentially unique case of the government-public opinion relationship under the pandemic.

Acknowledgements

The authors would like to thank Masaaki Higashijima for his helpful comments on the initial development of the experimental design. The design received approval from the Academic Research Ethical Review Committee at Waseda University (approval number: 2020-336), and the pre-analysis plan for the analysis is registered at OSF (osf.io/wn6k5).

Funding

This work was supported by JSPS KAKENHI, Grant Number 19H00584.

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Appendix

Question wordings for outcome measures

Risk perception: How worried are you personally about COVID-19 at present? *Options: Not at all worried (0.00), Slightly worried (0.33), Moderately worried (0.66), Very worried (1.00).*

Policy evaluations: Do you think the government has been handling the spread of COVID-19 in the country well in the following policy areas? *Options: Not well at all (0.00), Not very well (0.33), Fairly well (0.66), Very well (1.00).* *Taking average of all sub-questions.

- Disseminate information on lifestyle that is effective in preventing infection (e.g., washing hands, wearing masks, social-distancing etc)
- Number of PCR tests
- Medical care systems for those who become infected
- Financial aid to deal with economic difficulties
- Appropriateness of timing of declaring state of emergency
- Contents and levels of lockdowns and quarantine policies

Health behavior: How frequently do you expect to do each of the following actions in the next six months? *Options: Always (1.00), Very often (0.75), Sometimes (0.50), Rarely (0.25), Never (0.00).* *Taking average of all sub-questions.

- Go to crowded places *(reversed)*

- Consciously maintain a distance of at least 1-1.5m from others
- Leave home or go traveling outside of basic, necessary needs *(reversed)*
- Wear a face mask when leaving home
- Cover cough and sneeze with a tissue, handkerchief, etc.
- Wash your hands with soap and use hand sanitizer
- Touch your face and eyes with unwashed hands *(reversed)*
- Handshakes, hugging, and face kissing *(reversed)*
- Disinfect surfaces of personal objects and places

Future improvement: Think about the development of COVID-19 outbreak in the next six months. How likely do you think the following will happen? *Options: Not at all likely (0.00), Slightly likely (0.33), Moderately likely (0.66), Very likely (1.00).* *Taking average of all sub-questions.

- The development and wide supply of vaccines against COVID-19
- The development and wide supply of medicines that relieve the critical symptoms of COVID-19
- The rate of new COVID-19 infections in Japan will drop significantly
- The rate of new COVID-19 related deaths in Japan will drop significantly

Online Appendix

This is the Online Appendix of the article "Public reactions toward government-sponsored COVID-19 information in Japan."

A Main Analysis OLS Regression Table

Table A1: The effect of government-sponsored information and message on COVID-19 severity guess

	Risk Perception	Policy Evaluation	Health Behavior	Future Improvement
Condition 1	0.038	0.020	0.015	−0.027
	(0.032)	(0.021)	(0.013)	(0.025)
Condition 2	0.031	0.019	0.014	−0.047†
	(0.033)	(0.019)	(0.013)	(0.024)
Condition 3	0.031	0.029	0.014	0.003
	(0.034)	(0.020)	(0.013)	(0.026)
Condition 4	0.014	0.021	0.014	−0.005
	(0.032)	(0.019)	(0.014)	(0.024)
Condition 5	−0.015	0.023	−0.004	−0.030
	(0.037)	(0.020)	(0.016)	(0.026)
Condition 6	0.004	0.020	0.008	−0.020
	(0.033)	(0.021)	(0.014)	(0.025)
Severity Guess (Logged, by 1SD)	0.011	−0.012	0.017†	0.021
	(0.024)	(0.014)	(0.010)	(0.017)
Cond. 1 * Severity	0.039	0.013	0.004	−0.016
	(0.029)	(0.018)	(0.013)	(0.022)
Cond. 2 * Severity	0.014	0.005	−0.007	−0.020
	(0.034)	(0.017)	(0.013)	(0.023)
Cond. 3 * Severity	0.011	0.033†	−0.003	−0.008
	(0.033)	(0.019)	(0.014)	(0.025)
Cond. 4 * Severity	0.053†	0.016	0.005	0.015
	(0.031)	(0.019)	(0.014)	(0.023)
Cond. 5 * Severity	−0.016	0.018	−0.003	−0.036
	(0.038)	(0.018)	(0.016)	(0.024)
Cond. 6 * Severity	0.015	0.009	−0.003	−0.015
	(0.033)	(0.021)	(0.014)	(0.024)
Government Trust (Min. to Max.)	−0.018	0.162***	−0.002	0.096***
	(0.014)	(0.008)	(0.006)	(0.010)
WHO Trust (Min. to Max.)	0.015	0.015†	−0.004	0.005
	(0.014)	(0.008)	(0.006)	(0.011)
Political Knowledge (Min. to Max.)	−0.034	−0.020	0.031*	−0.043†
	(0.029)	(0.018)	(0.012)	(0.023)
Infections Experience (Dummy)	0.023	−0.013	0.000	−0.001
	(0.016)	(0.010)	(0.007)	(0.013)
Gender (Female)	0.056***	0.010	0.056***	−0.032**
	(0.015)	(0.009)	(0.006)	(0.011)
Age (by 10 years)	0.023***	0.003	0.009***	0.014***
	(0.005)	(0.003)	(0.002)	(0.004)
Education (Min. to Max.)	0.014	−0.037*	−0.002	−0.025
	(0.025)	(0.015)	(0.011)	(0.018)
Income (Min. to Max.)	0.022	0.015	0.045***	0.002
	(0.030)	(0.018)	(0.013)	(0.024)
Income (Non-Response)	0.029	−0.017	0.028***	−0.035*
	(0.021)	(0.013)	(0.008)	(0.016)
Unemployed (Dummy)	0.009	−0.018†	0.007	0.001
	(0.017)	(0.010)	(0.007)	(0.013)
Service Worker (Dummy)	−0.011	−0.009	0.007	0.010
	(0.016)	(0.009)	(0.007)	(0.012)
Date of Interview (by 1SD)	0.032	−0.006	0.005	−0.006
	(0.024)	(0.014)	(0.010)	(0.018)
(Intercept)	0.484***	0.351***	0.640***	0.548***
	(0.044)	(0.027)	(0.018)	(0.033)
R^2	0.047	0.209	0.099	0.073
Adj. R^2	0.033	0.198	0.086	0.060
Num. obs.	1819	1787	1795	1798
RMSE	0.281	0.166	0.118	0.213

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$

B Institutional Trust Moderation Analysis OLS Regression Table

Table A2: The effect of government-sponsored information and message on COVID-19 severity guess conditioned by institutional trust

	Risk Perception	Policy Evaluation	Health Behavior	Future Improvement
Condition 1	0.019 (0.049)	0.029 (0.035)	−0.007 (0.019)	−0.020 (0.041)
Condition 2	0.056 (0.052)	0.013 (0.036)	0.003 (0.023)	−0.035 (0.040)
Condition 3	0.042 (0.052)	0.045 (0.032)	0.001 (0.020)	−0.038 (0.043)
Condition 4	−0.008 (0.049)	0.030 (0.033)	−0.017 (0.022)	−0.008 (0.040)
Condition 5	−0.043 (0.060)	0.019 (0.036)	−0.008 (0.026)	−0.025 (0.042)
Condition 6	−0.049 (0.053)	0.037 (0.035)	−0.026 (0.021)	−0.019 (0.041)
Severity Guess (Logged, by 1SD)	0.062 (0.039)	−0.025 (0.026)	0.021 (0.016)	0.019 (0.031)
Cond. 1 * Severity	0.006 (0.043)	0.023 (0.031)	−0.005 (0.019)	−0.027 (0.039)
Cond. 2 * Severity	0.067 (0.054)	0.008 (0.034)	−0.011 (0.022)	−0.015 (0.039)
Cond. 3 * Severity	−0.010 (0.049)	0.026 (0.031)	0.012 (0.021)	−0.022 (0.045)
Cond. 4 * Severity	0.017 (0.046)	0.036 (0.033)	−0.003 (0.022)	0.035 (0.038)
Cond. 5 * Severity	−0.033 (0.058)	0.024 (0.031)	0.009 (0.025)	−0.027 (0.038)
Cond. 6 * Severity	−0.082 (0.050)†	0.034 (0.036)	−0.021 (0.021)	−0.003 (0.038)
Government Trust (Min. to Max.)	−0.055 (0.049)	0.178 (0.030)***	−0.043 (0.020)*	0.131 (0.037)***
WHO Trust (Min. to Max.)	−0.003 (0.049)	0.012 (0.028)	0.007 (0.020)	−0.051 (0.035)
Cond. 1 * Gov. Trust	0.034 (0.067)	−0.045 (0.045)	0.046 (0.027)†	−0.074 (0.051)
Cond. 2 * Gov. Trust	−0.058 (0.066)	0.019 (0.040)	0.028 (0.026)	−0.038 (0.049)
Cond. 3 * Gov. Trust	−0.062 (0.069)	0.033 (0.041)	0.011 (0.026)	−0.012 (0.053)
Cond. 4 * Gov. Trust	0.004 (0.066)	−0.030 (0.040)	0.070 (0.027)*	−0.062 (0.050)
Cond. 5 * Gov. Trust	0.106 (0.073)	−0.028 (0.042)	0.038 (0.030)	−0.047 (0.054)
Cond. 6 * Gov. Trust	0.063 (0.067)	−0.002 (0.044)	0.050 (0.027)†	−0.018 (0.051)
Cond. 1 * WHO Trust	−0.011 (0.066)	0.029 (0.044)	−0.006 (0.027)	0.080 (0.050)
Cond. 2 * WHO Trust	0.022 (0.065)	−0.010 (0.038)	−0.014 (0.026)	0.015 (0.048)
Cond. 3 * WHO Trust	0.018 (0.068)	−0.067 (0.041)†	0.001 (0.027)	0.121 (0.052)*
Cond. 4 * WHO Trust	0.007 (0.066)	0.016 (0.039)	−0.011 (0.028)	0.069 (0.048)
Cond. 5 * WHO Trust	−0.070 (0.073)	0.051 (0.042)	−0.044 (0.030)	0.041 (0.053)
Cond. 6 * WHO Trust	0.042 (0.069)	−0.044 (0.045)	0.021 (0.028)	0.018 (0.051)
Cond. 1 * Severity * Gov. Trust	0.085 (0.062)	−0.034 (0.040)	0.066 (0.027)*	0.022 (0.048)
Cond. 2 * Severity * Gov. Trust	−0.016 (0.064)	0.010 (0.037)	0.046 (0.025)†	0.020 (0.046)
Cond. 3 * Severity * Gov. Trust	0.012 (0.066)	0.024 (0.039)	0.013 (0.026)	−0.027 (0.053)
Cond. 4 * Severity * Gov. Trust	0.005 (0.062)	−0.030 (0.037)	0.059 (0.027)*	−0.074 (0.048)
Cond. 5 * Severity * Gov. Trust	0.109 (0.070)	−0.005 (0.038)	0.036 (0.029)	−0.044 (0.050)
Cond. 6 * Severity * Gov. Trust	0.182 (0.064)**	0.005 (0.043)	0.058 (0.026)*	−0.016 (0.050)
Cond. 1 * Severity * WHO Trust	−0.038 (0.061)	0.017 (0.039)	−0.059 (0.026)*	0.006 (0.048)
Cond. 2 * Severity * WHO Trust	−0.082 (0.060)	−0.022 (0.035)	−0.051 (0.025)*	−0.039 (0.044)
Cond. 3 * Severity * WHO Trust	0.002 (0.064)	−0.007 (0.038)	−0.062 (0.026)*	0.075 (0.052)
Cond. 4 * Severity * WHO Trust	0.033 (0.061)	−0.016 (0.035)	−0.049 (0.027)†	0.017 (0.046)
Cond. 5 * Severity * WHO Trust	−0.095 (0.068)	0.000 (0.037)	−0.081 (0.029)**	0.028 (0.048)
Cond. 6 * Severity * WHO Trust	0.006 (0.066)	−0.075 (0.044)†	−0.024 (0.028)	−0.012 (0.050)
Political Knowledge (Min. to Max.)	−0.028 (0.029)	−0.020 (0.019)	0.026 (0.012)*	−0.045 (0.023)*
Infections Experience (Dummy)	0.023 (0.017)	−0.015 (0.010)	−0.000 (0.007)	0.001 (0.013)
Gender (Female)	0.059 (0.015)***	0.008 (0.009)	0.056 (0.006)***	−0.031 (0.011)**
Age (by 10 years)	0.023 (0.005)***	0.003 (0.003)	0.009 (0.002)***	0.014 (0.004)***
Education (Min. to Max.)	0.011 (0.024)	−0.038 (0.015)*	0.000 (0.010)	−0.023 (0.018)
Income (Min. to Max.)	0.023 (0.030)	0.019 (0.019)	0.044 (0.013)***	−0.002 (0.024)
Income (Non-Response)	0.030 (0.021)	−0.015 (0.013)	0.026 (0.008)**	−0.036 (0.016)*
Unemployed (Dummy)	0.004 (0.017)	−0.018 (0.010)†	0.007 (0.007)	−0.002 (0.013)
Service Worker (Dummy)	−0.013 (0.016)	−0.009 (0.009)	0.007 (0.007)	0.008 (0.012)
Date of Interview (by 1SD)	0.027 (0.024)	−0.002 (0.014)	0.004 (0.010)	−0.007 (0.018)
(Intercept)	0.514 (0.052)***	0.343 (0.035)***	0.660 (0.021)***	0.553 (0.042)***
R^2	0.069	0.223	0.115	0.087
Adj. R^2	0.042	0.200	0.089	0.061
Num. obs.	1819	1787	1795	1798
RMSE	0.279	0.166	0.118	0.213

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.1$

C Treatment Effect Estimates for Government Trusters and WHO Trusters

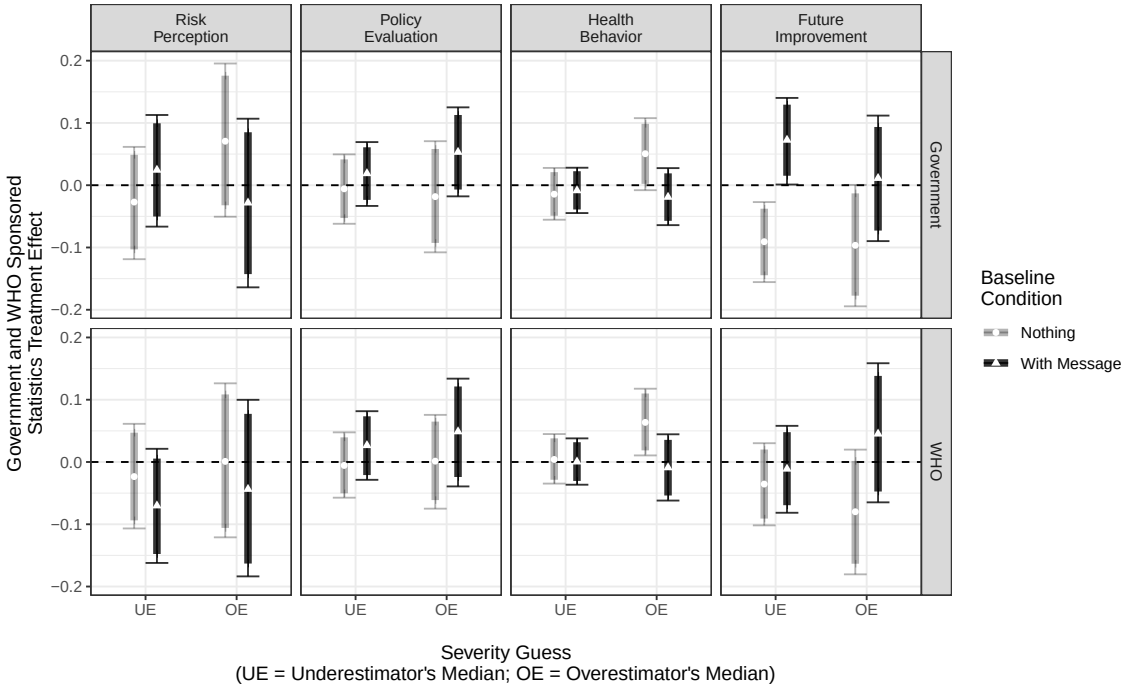

Figure A1: Effects of government-sponsored and WHO-sponsored statistics treatments on COVID-19 related risk perception, policy evaluation, health behavior, and future improvement (government trusters)

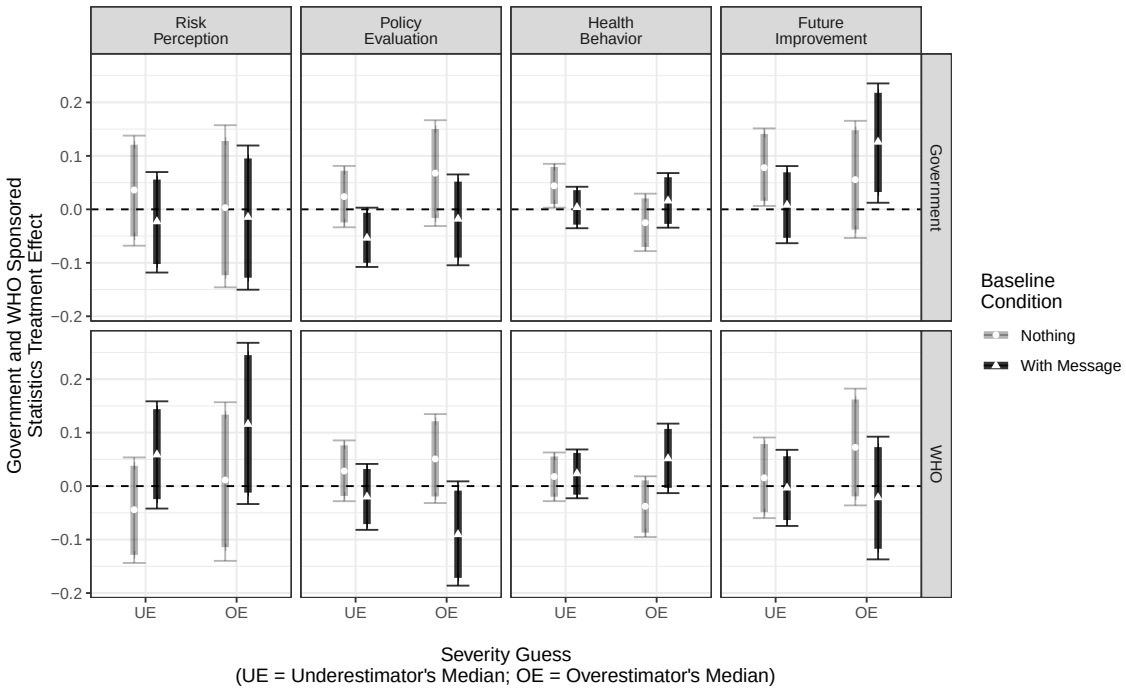

Figure A2: Effects of government-sponsored and WHO-sponsored statistics treatments on COVID-19 related risk perception, policy evaluation, health behavior, and future improvement (WHO trusters)

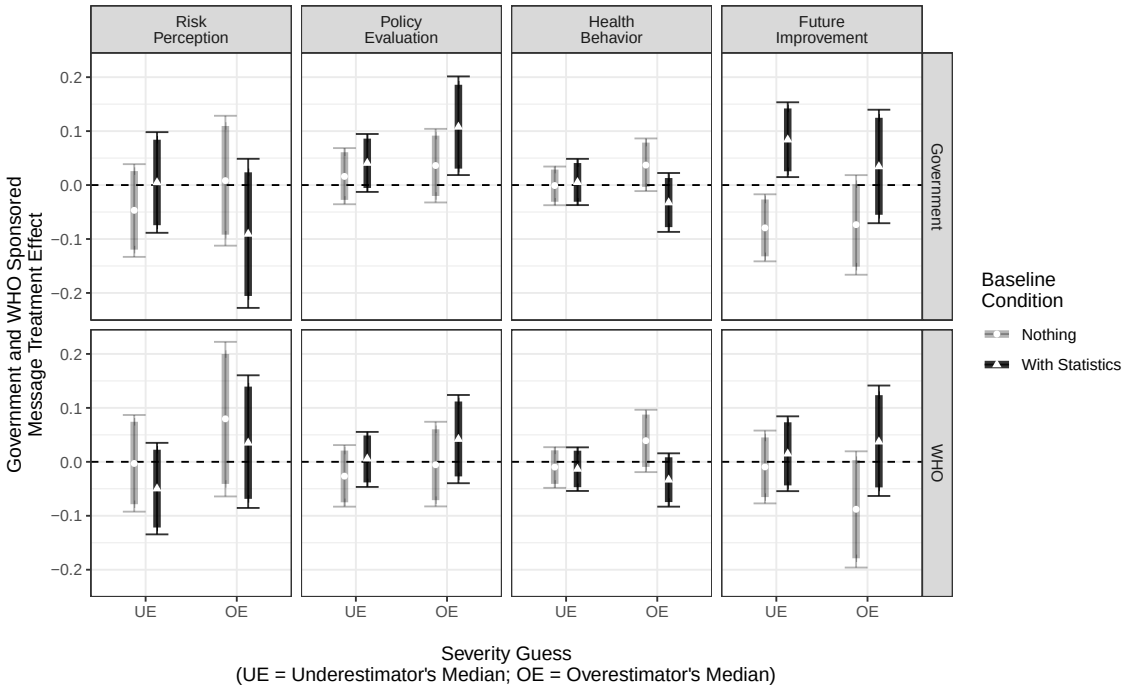

Figure A3: Effects of government-sponsored and WHO-sponsored message treatments on COVID-19 related risk perception, policy evaluation, health behavior, and future improvement (government trusters)

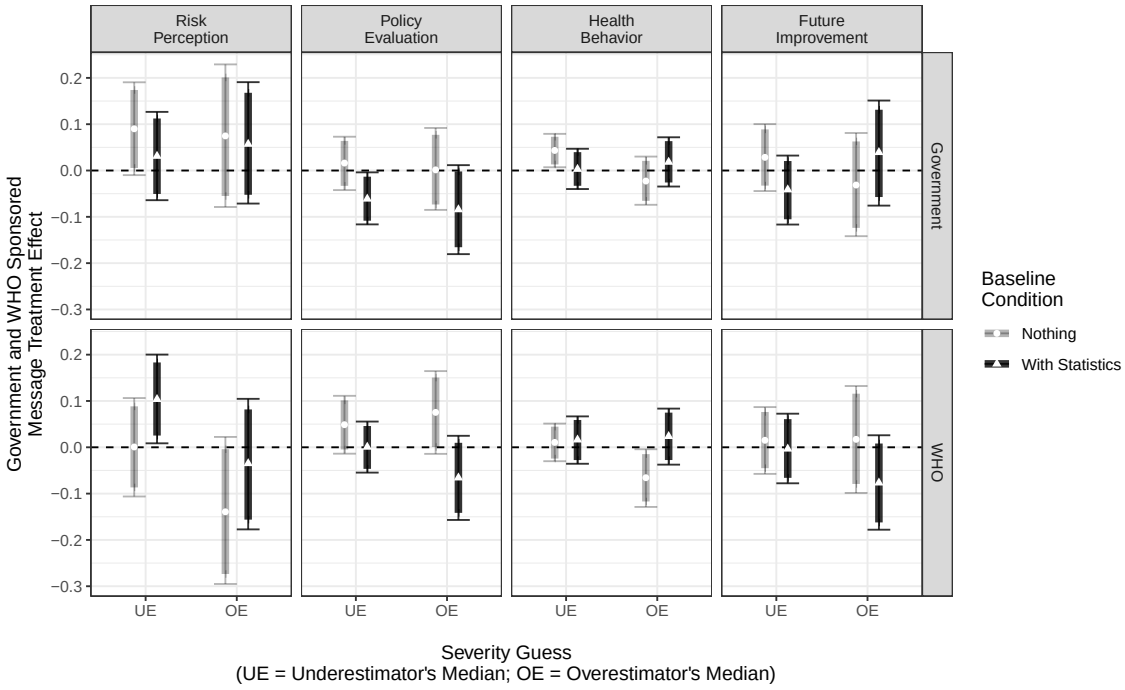

Figure A4: Effects of government-sponsored and WHO-sponsored message treatments on COVID-19 related risk perception, policy evaluation, health behavior intention, and future improvement (WHO trusters)

D Post-Experiment Recall of Assigned Treatments

Table A3 shows the patterns of the recall of treatment assignments. Underlined percentages indicate correct recalls. The relevant questions were asked after all the outcome questions were asked; therefore, given the time passed, incorrect recall does not necessarily mean that the respondents do not recognize the assignment. The table indicates that, when they recalled something, many respondents did recall their treatments correctly; thus, the treatments are not entirely meaningless. The general rate of recall was not very high (many answered with "none" or just skipped the question), which may have been due to the complex wordings and structure of the recall questions.

Table A3: Recall of Information Assignment and Sources. Asked after all the outcome questions.

	Statistics Source				Message Source			
	JP	WHO	None	DK/NA	JP	WHO	None	DK/NA
Cond. 0	11%	1%	**54%**	34%	3%	5%	**59%**	33%
Cond. 1	**47%**	2%	9%	42%	3%	5%	**43%**	49%
Cond. 2	7%	1%	**52%**	39%	**17%**	6%	30%	47%
Cond. 3	**49%**	3%	7%	41%	**20%**	16%	11%	53%
Cond. 4	14%	**41%**	11%	33%	2%	7%	**45%**	46%
Cond. 5	11%	3%	**47%**	39%	2%	**28%**	21%	48%
Cond. 6	15%	**46%**	6%	33%	2%	**38%**	15%	45%

Note: JP = Japanese Government, None=Not shown in the survey.