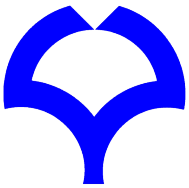

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Nudges for COVID-19 voluntary vaccination: How to explain peer information?

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Abstract:
Promoting vaccination is a crucial strategy to end the COVID-19 pandemic; however, individual autonomy should be respected at the same time. This study aimed to discover behavioral economics nudges that can reinforce people's intention to receive the COVID-19 vaccine without impeding their autonomous decision-making. In March 2021, we conducted a pre-registered, online experiment with 1,595 Japanese nationwide sample, and randomly assigned them to one of a control group and three treatment groups that provided the following other-regarding messages: Message A ("X out of 10 people in your age group answered they would receive this vaccine"), Message B ("Your vaccination behavior can encourage the vaccination behavior of the people around you"), or Message C ("If you do not receive the vaccine, the people around you also may not do so"). By comparing the messages' effects on vaccination intention, autonomous decision-making, and emotional burden, we found that Message B was effective in increasing the number of older adults who newly decided to receive the vaccine. Messages A and C further reinforced the intention of older adults who had already planned to receive it. However, Message C, which conveys similar information to Message B with loss-framing, increased viewers' emotional burden. These three messages had no promoting effect for young adults with lower vaccination intentions at baseline. Based on the above findings, we propose that governments should use different messages depending on their purposes and targets, such as Message A instead of Message C, to encourage voluntary vaccination behavior.

Keywords: Herd immunity, Behavioral public policy, Nudge, Framing effect, Autonomy
JEL codes: I12, D91, C90

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1. Introduction

Promoting vaccination is a crucial strategy to end the COVID-19 pandemic. Promotion measures potentially include options from simple information provision to legal mandates. However, compulsory measures are rare, and some degree of self-selection is preferred, because public health is guided by the least restrictive alternative, which states that we must select measures that place the least restrictions on individual freedom and rights, to achieve a public good, including herd immunity (Giubilini, 2021). Since the COVID-19 vaccine has been newly developed and there are uncertainties and ambiguity regarding its long-term efficacy and adverse reactions, it is important to respect individual autonomy. Behavioral economics defines nudge as "an aspect of choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler and Sunstein, 2008, p.6). Nudge has been used for promoting COVID-19 social distancing (Lunn et al., 2020; Sasaki et al., 2021), and will be relevant in the above setting.

We investigated whether nudge-based messages, which provided information on others' vaccination decisions and behaviors, strengthen people's intentions to receive the COVID-19 vaccine. This study's uniqueness is that we used three messages differently describing others' information, and compared their effects on people's vaccination

intentions, autonomous decision-making, and emotional burden. In addition, this study contrasted older adults, who is the target of priority vaccination in lots of countries, with young adults, who will be eligible for vaccination later.

2. Literature Review

Behavioral science studies have informed others' decisions and behaviors and attempted to transform people's behaviors in socially desirable directions in various policy fields, including energy savings, tax payment, and charitable giving (Allcott, 2011; Hallsworth et al., 2017; Shang and Croson, 2009).

This type of intervention is called a social-comparison nudge and can be effective in encouraging COVID-19 vaccination. Latkin et al. (2021) found that social norms are strongly associated with people's trust for the COVID-19 vaccine. In a large-scale survey of 23 countries, Moehring et al. (2021) actually found that providing information about others' vaccination intentions strengthened survey participants' intentions.

Social-comparison nudges have two strengths in implementation over defaults, in which people's choices are pre-determined by socially recommended options. First, they are less expensive to implement, because they simply add information on mail, homepage, etc. However, the defaults require changes in procedure and setting, which impose larger

financial and time costs. Second, they respect people's autonomous decision-making, because people need to voluntarily choose the socially recommended option if they wish. The defaults can lead to situations, where the choices of people who are unaware of the setting are pre-determined. Thus, the defaults pose a higher risk of forcing people to make choices they might not wish to make than the comparison nudges. Behavioral economics calls such inconsiderate interventions sludge and suggests they should not be employed (Sunstein, 2020; Thaler, 2018).

However, since the recipients of social-comparison nudges could feel emotional pain and anxiety, there is scope for social welfare improvements by preventing such emotional costs. Social-comparison nudges promote behavioral changes, by making people aware of the disutility of not behaving in the same way as others. If this prompts those who wish to receive the COVID-19 vaccine but have difficulty in doing so on their own, their welfare will improve. However, those who can receive it without a nudge or those unable to receive it will not see any improvement in their welfare when receiving the nudges. If the nudges generate negative emotions, their welfare will rather deteriorate. Therefore, messages should ensure that receivers do not experience negative emotions.

There has been a growing body of research on the emotional costs of providing information (Allcott and Kessler, 2019; Thunström, 2019): however, no study has

explicitly considered the emotional cost of nudges in COVID-19 vaccination, to our knowledge. The least restrictive alternative prefers a less emotionally burdensome nudge. Again, since the long-term consequences of the vaccine have not yet been confirmed, the nudge that recommends vaccination with as little emotional burden as possible and respect for people's autonomous decision-making is desirable. This study contributes to the literature by simultaneously considering the impacts of other-regarding nudges on vaccination intention and on autonomous decision-making and emotional burden.

3. Experimental Design

3.1. Overview

We conducted a pre-registered, online experiment with a Japanese nationwide sample over a 3-day period from March 16–18, 2021. We commissioned MyVoiceCom Co. Ltd., recruited respondents from their monitors throughout Japan, and conducted the survey. Since vaccination for ordinary people did not yet start in Japan at the time of conducting this experiment, we can evaluate the impacts of nudge-based messages for those with strong intentions to receive the vaccine to those with weak intentions.

In Japan, vaccination for healthcare workers firstly started on February, 2021, and then that for ordinary older adults (65 years and older) started on April. We collected

1,595 valid responses, including 798 older adults (65–74 years) and 797 young adults (25–34 years), who would be eligible for vaccination quite later.

We obtained ex-ante approval from the ethics committee of Graduate School of Economics, Osaka University. We also registered the experimental design with the AEA RCT Registry (Sasaki, Ohtake and Saito, 2021).

3.2. Nudge-based Messages

We randomly assigned the 1,595 respondents to one of four groups. The messages for each group are shown in Figure 1. Explanations on the effectiveness of the COVID-19 vaccine, adverse reactions, and how to deal with adverse reactions were the same for all groups. We created the explanations based on the Japanese actual vaccination program (Prime Minister's Office, 2021) to have respondents imagine vaccination situations in detail and prevent inconsistency between their experimental choices and real behaviors (Sheeran and Webb, 2016).

For the three treatment groups, we display each nudge-based message in addition to the above common explanations. Group A conveys the proportion of people willing to receive the COVID-19 vaccine. Specifically, the message for older (young) adults is "7–8 (6–7) out of 10 people in your age group answered they would receive this vaccine."

These statistics are from another nationwide survey, which we conducted in January 2021 (Sasaki, Saito, and Ohtake, 2021). We call these messages social-comparison nudges (in short, comparison).

Groups B and C focus on that respondents' own vaccination behaviors possibly influence those of others. This assumes that simple social-comparison nudges strengthen vaccination intentions. Our pre-survey analysis found that as the vaccination rate of the same age group increases, the vaccination intention of the respondents also increases (Sasaki, Saito, and Ohtake, 2021), and supports the assumption. Organizational psychology suggests people prefer to influence others (Bolino, 1999). Another study reported that people's disaster evacuation intentions increase significantly when receiving messages informing their own evacuation behavior can promote those of others (Ohtake et al., 2020). Using this type of message can make people shift their attention from the disutility of not following social norms to the selfish utility of influencing others and the society.

The message for group B is "Your vaccination behavior can encourage the vaccination behavior of the people around you." Group C expresses the same content as group B using loss-framing: "If you do not receive the vaccine, the people around you may also not do so." We call the former gain-framed social influence nudge (influence-

gain) and the latter loss-framed social influence nudge (influence-loss).

Tversky and Kahneman's (1981) prospect theory states that people's choices depend on whether they are framed in terms of gain or loss, even if their substance is essentially equivalent. Although a loss-framed message is theoretically expected to be more effective for behavioral change than a gain-framed message, their effectiveness empirically depends on contexts (Detweiler et al., 1999; Schneider et al., 2001). Heffner et al. (2020) reported that both gain and loss framings promote social-distancing intention, while only the loss framing generates negative emotions. Therefore, compared to the gain framing, the loss framing will place a heavier emotional burden on the viewer and inhibit autonomous decision-making in the context of vaccination.

3.3. Outcome Measures

3.3.1 Primary Outcomes: Willingness to Pay for the COVID-19 Vaccine

After each nudge-based message, we set up a question to measure the respondents' willingness to pay (WTP) for the COVID-19 vaccine. WTP is the maximum amount they are willing to pay for the vaccine, expressing the strength of their vaccination intentions. This measure has been used in other studies on the COVID-19 vaccine (Cerda and García, 2021; Wong et al., 2020).

The respondents were first asked: “Suppose you can receive this vaccine without having to pay out-of-pocket, will you visit the vaccination camp and receive it?” Next, those who answered they would receive the free vaccine proceed to the question on the payment setting (left panel, Figure 2), while those who answered that they would not, proceed to the question on the receipt setting (right panel). The questions have a Multiple Price List format, often used to calculate WTP (Anderson et al., 2006). We define WTP as the midpoint of the amounts around the switching point. For example, a respondent answers they will receive the vaccine if they need to pay ¥8,000 or less, while they will not if they need to pay ¥10,000 or more; the WTP is ¥9,000. This means they want to receive the vaccine even if they need to pay ¥9,000. However, another respondent answers that they will not receive the vaccine even if they can receive ¥15,000 or less, while they will if they can receive ¥20,000 or more; their WTP is -¥17,500. This means they do not want to get vaccinated unless they receive ¥17,500 or more. The WTP for those who answer that they will receive the vaccine under all choices, including the maximum amount of ¥30,000, becomes ¥35,000. The WTP of those who answer that they will not receive it under all choices becomes -¥35,000. One US dollar was approximately equivalent to 108 Japanese yen on March, 2021.

3.3.2 Secondary Outcomes: Autonomy and Emotional Burden

After the WTP question, we presented the following four questions to clarify whether adding nudge-based messages inhibits respondents' autonomous decision-making and generates negative emotions compared to the common explanations in the control group: "Did you want to receive the vaccine voluntarily?" (voluntary), "Did you think you were being forced to receive the vaccine?" (forced), "Did you feel distressed when you received the explanation of the vaccine?" (distressed), and "Did you feel that the explanation of the vaccine needed to be improved?" (should be improved). We created these questions, considering end-of-life care studies that have long focused on patients' autonomous decision-making (Ngo-Metzger et al., 2008). The questions were rated on a five-point scale.

3.4 Descriptive Statistics

Appendix Table A shows the descriptive statistics for the older and young respondents. The distributions of age, gender, marital status, family structure, years of education, and household annual income are almost balanced, while our estimations directly control for the influence of these variables, since the proportions of respondents living together aged 65 or older and not answering income information are partly unbalanced.

4. Results

4.1 Effects on Vaccination Intentions

First, we present vaccination intention levels in the control group. The proportion of older respondents willing to receive the free vaccine is 84.4%, which is higher than for young adults, at 67.0%. The average WTP is ¥427.1 among older adults and -¥3,300.0 among the young.

Figure 3 shows the effect of nudge-based messages on vaccination intentions, setting the control group as a baseline. The messages were effective for older respondents. In group B with the influence-gain nudge, the proportion of older adults willing to receive the free vaccine increased by around 7% ($p<.05$) compared to the control group, reaching 91.5%. The WTP also increased by ¥2,797.9 ($p<.10$). In group C, with the loss-framed message, the WTP increased by ¥3,361.8 ($p<.05$) compared to the control group, reaching ¥3,789. This is almost nine times higher than that of the control group, at ¥427.1. However, these messages did not have any promoting effect on the young with lower vaccination intentions at baseline.

Table 1 shows the messages' effects, using regression analysis and controlling for the influence of the attribute variables in Section 3.4. According to columns 1 and 2, the promoting effects for older adults changed little in magnitude and statistical significance

(in order: 6%, $p<.05$; ¥2,353.4, $p<.10$; ¥3,495.8, $p<.05$).

Furthermore, we changed the WTP variable into the following two variables. The first changed negative WTP values (below ¥0) to ¥0, and then focused on positive WTP values in the payment setting. The second changed positive WTP values (over ¥0) to ¥0, and focused on negative WTP values in the receipt setting. Using the first enables us to determine the messages' effects on the vaccination intentions of those who have already intended to receive the free vaccine, and vice versa. Our estimation uses the Tobit model here, because the threshold of ¥0 biases OLS estimates. The marginal effects are reported in columns 3, 4, 7, and 8.

The results show that, for older respondents, the influence-gain nudge had the effect of increasing the intentions of those who did not yet intended to receive the free vaccine, while the loss-framed nudge further strengthened the intentions of the other subgroup with originally higher intentions. A new finding is that the comparison nudge had the same impact as the loss-framed message (¥1.148.9, $p<.01$). The null hypothesis that the comparison nudge's effect is equal to the loss-framed message's is not rejected ($p=.47$). The failure to find the promoting effect of the comparison nudge in Figure 3 and column 2 of Table 1 may be because this message possibly works to weaken the intentions of those who have not intended to receive the free vaccine (-¥522.81, $p=.49$).

4.2. Effects on Autonomy and Emotional Burden

Table 2 uses the levels of respondents' autonomous decision-making and emotional burden as alternative outcomes. The influence-loss nudge worsened their autonomy and emotional burden compared to the control group. This message led to higher mental stress for older adults ($p<.05$) and made the young feel that they are forced to receive the vaccine and that the explanation of the vaccine should be improved ($p<.01$ for both).

The above concerns are not observed under the comparison nudge and the gain-framed nudge. However, the constant terms make us recognize that autonomy might have already been inhibited and emotional burden might have been placed for older adults in the control group. The degrees, to which they feel that they are forced to take the vaccination and the explanation should be improved, are near the maximum value of 5. The null hypothesis that the constant term is equal to 5 is not rejected (in order $p=.72$, $p=.99$). The common explanations are based on the official ones of the Prime Minister's Office (2021). Although this result may suggest that the official explanations should be improved, the average level of younger respondents who viewed the same explanations is 3, which is "neutral." The null hypothesis that the constant term is equal to 3 is not rejected (in order $p=.93$, $p=.42$). It is also possible that older adults felt considerable social pressure to get vaccinated during March 2021 when we conducted this experiment, which

was reflected in their responses.

At the end of this experiment, we conducted debriefing, offered respondents an opportunity to change their vaccination decision, but confirmed that few of them changed the decision (Please see Appendix Table B).

5. Discussion, Limitations, and Conclusions

Our online experiment suggested that other-regarding messages had the following effects on COVID-19 vaccination intentions. First, the influence-gain nudge increased the proportion of older adults who will receive the vaccine if it is offered for free. Second, the vaccination intentions of older adults who already intended to receive it further strengthened because of the loss-framed nudge and the comparison nudge. However, the former message placed an emotional burden on viewers. Third, these messages did not have any promoting effect for young adults with lower vaccination intentions at baseline.

The result that the gain-framed message is less emotionally burdensome than the loss-framed one is consistent with that of the COVID-19 social distancing study (Heffner et al., 2020). As in the study conducted in other countries (Moehring et al., 2021), the comparison nudge will work in Japan, but may weaken the intentions of older adults who have not yet intended to receive the vaccine.

Our findings suggest that governments should use different messages depending on purposes and targets. First, the gain-framed nudge will be effective for increasing the number of older adults who newly decide to receive the vaccine. One option is to include this message on public posters and websites. Second, the comparison nudge will be effective for reinforcing the intentions of older adults who have already intended to receive the vaccine and ensuring their vaccination is carried out. Regarding social welfare, the governments should use the comparison nudge, instead of the loss-framed nudge that has the similar promoting effect but increases the emotional burden of the viewers. However, since the comparison nudge may further weaken the vaccination intentions of older adults with originally lower intentions, it is necessary to display this message only to those who wish to get vaccinated. One option is to include this message on the reservation screen for vaccination or in reminder e-mails.

Our messages had no promoting effect for younger generation. Policymakers need to consider developing other nudge-based messages and adopting monetary incentives, to reliably encourage vaccination of this generation with more vaccine hesitancy. Further, the messages did not inhibit autonomy or emotion, but did not improve them either. Given that many of older respondents already felt they were forced to get vaccinated when they received the actual explanations, policymakers need to explore other expressions that are

more respectful of autonomous decision-making.

This study has one limitation that respondents' choices are hypothetical. Although we design the hypothetical question as close as possible to the Japan's actual vaccination program, there may exist some gaps between the experimental choices and real behaviors. However, since existing studies have reported that nudge-based messages can promote seasonal influenza vaccination behavior (e.g., Milkman et al., 2021), our messages may be effective also for behaviors. In addition, whether this study's results are applicable to other countries should be tested by future research.

Despite the limitations, this study makes significant academic and policy contributions, because no other study has explored desirable nudge-based messages in the context of COVID-19 vaccination, considering not only vaccination intentions but also autonomy and emotional burden. COVID-19 vaccination has recently started worldwide, and our findings can contribute to the improvement of vaccination programs.

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Appendix

Table A. Descriptive Statistics

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Old respondents (65-74 years)				**Young respondents (25-34 years)**		
		Control	Treamet A	Treamet B	Treamet C	Control	Treamet A	Treamet B	Treamet C
			Comparison	**Influence-gain**	**Influence-loss**		**Comparison**	**Influence-gain**	**Influence-loss**
Number of observations =		199	200	200	199	200	199	199	199
Variables:									
Age	Mean	68.95	69.22	69.33	68.95	29.97	30.19	30.40	30.39
	S.D.	2.79	2.72	2.81	2.82	2.67	2.75	2.68	2.89
Female (dummy)	Mean	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
	S.D.	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Married (dummy)	Mean	0.82	0.80	0.84	0.80	0.37	0.40	0.40	0.41
	S.D.	0.38	0.40	0.37	0.40	0.48	0.49	0.49	0.49
Divorce / Bereavement (dummy)	Mean	0.13	0.15	0.09	0.14	0.02	0.02	0.01	0.01
	S.D.	0.33	0.36	0.29	0.34	0.12	0.12	0.10	0.07
Number of family members living together	Mean	2.45	2.52	2.52	2.52	3.11	2.98	3.02	2.92
	S.D.	1.08	1.17	1.02	0.94	1.53	1.28	1.45	1.42
Family members living together aged 65 or older (dummy)	Mean	0.69	0.72	0.71	0.69	0.21	0.13	0.18	0.16
	S.D.	0.46	0.45	0.46	0.46	0.40	0.34	0.39	0.37
Educational years	Mean	14.14	14.17	14.20	14.07	14.67	14.79	14.86	14.77
	S.D.	2.10	2.07	1.99	2.02	2.05	1.87	2.16	2.21
Household annual income (Unit: 10 thousand yen)	Mean	539.95	541.25	523.50	528.64	593.00	597.74	543.22	563.07
	S.D.	373.05	381.40	340.89	354.39	350.52	297.69	288.14	326.61
No income information (dummy)	Mean	0.22	0.20	0.14	0.17	0.22	0.18	0.14	0.20
	S.D.	0.42	0.40	0.34	0.38	0.41	0.38	0.35	0.40

Notes: 1) Some participants did not answered annual household income. We imputed the average amout of the income for such respondents while considering that they did not answer it by using the variable of no income information. 2) The distributions of age, gender, marital status, family structure, years of education, and household annual income are almost balanced, while our estimations directly control for the influence of these variables, since the proportion of young respondents living together aged 65 or older is lower in Treatment A than in Control and that of old and young respondents not answering income information is lower in Treatment B than in Control. 3) We set a question to ascertain whether respondents read our descriptions carefully. We displayed a caution message to those respondents who were found not to have read carefully, while empirically controlling for them.

Table B. Change in Selection

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Old respondents (65-74 years)				**Young respondents (25-34 years)**			
	Control	Treamet A	Treamet B	Treamet C	Control	Treamet A	Treamet B	Treamet C
		Comparison	**Influence-gain**	**Influence-loss**		**Comparison**	**Influence-gain**	**Influence-loss**
Number of observations =	199	200	200	199	200	199	199	199
Change to "receive"	2	2	1	3	8	0	3	5
	1.01%	1.00%	0.50%	1.51%	4.00%	0.00%	1.51%	2.51%
No change	196	198	198	196	187	192	193	189
	98.49%	99.00%	99.00%	98.49%	93.50%	96.48%	96.98%	94.97%
Change to "do not receive"	1	0	1	0	5	7	3	5
	0.50%	0.00%	0.50%	0.00%	2.50%	3.52%	1.51%	2.51%

Notes: At the end of this experiment, we explained the research purpose to the respondents and clarified that the information on the vaccination intentions of others was described differently for each group We then presented them with another question to ascertain whether they would receive the free vaccine and offered them an opportunity to change their decision. Few respondents selected a different option from the one in the experiment. More concretely, there are only around 2–3 older respondents in each group who switched and around 10 in each group for the younger population, with the numbers being similar between groups.

Tables and Figure

Table 1. Message Effects on Vaccination Intentions

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Older respondents (65-74 years)				**Young respondents (25-34 years)**			
Number of observations:		798				797			
Estimation method:		OLS		Tobit model		OLS		Tobit model	
Dependent variable:		**Free-vaccine (binary)**	**WTP (both)**	**WTP (payment)**	**WTP (receipt)**	**Free-vaccine (binary)**	**WTP (both)**	**WTP (payment)**	**WTP (receipt)**
Treatment A	**Comparison**	-0.02	749.78	1,148.86***	-522.81	-0.01	-603.83	-153.12	-215.40
		(0.03)	(1,023.69)	(331.96)	(756.07)	(0.05)	(1,762.50)	(424.23)	(1,425.63)
Treatment B	**Influence-gain**	0.06**	2,353.35*	726.14	1,881.86**	-0.07	-2,289.22	-312.45	-1,908.36
		(0.03)	(1,270.15)	(628.11)	(870.34)	(0.06)	(1,530.41)	(487.84)	(1,279.23)
Treatment C	**Influence-loss**	0.04	3,495.81**	1,754.17**	990.35	0.06	241.94	114.94	1,180.14
		(0.03)	(1,605.95)	(702.35)	(851.27)	(0.04)	(1,345.88)	(363.58)	(1,158.64)
Attribute varibales		YES	YES	YES	YES	YES	YES	YES	YES

Note: Cluster robust standard errors at prefecture level in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 2. Message Effects on Autonomy and Emotional Burden

Estimation method: OLS		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Older respondents (65-74 years)				**Young respondents (25-34 years)**			
Number of observations:		798				797			
Dependent variable (5-point scale):		**voluntary**	**forced**	**distressed**	**should be improved**	**voluntary**	**forced**	**distressed**	**should be improved**
Treatment A	**Comparison**	-0.02	-0.09	0.04	0.06	-0.11	0.01	0.08	0.08
		(0.10)	(0.09)	(0.10)	(0.11)	(0.15)	(0.11)	(0.11)	(0.11)
Treatment B	**Influence-gain**	0.10	-0.06	0.07	0.05	-0.20	-0.01	0.10	0.14
		(0.13)	(0.16)	(0.10)	(0.12)	(0.14)	(0.09)	(0.09)	(0.09)
Treatment C	**Influence-loss**	0.09	0.08	0.17**	0.14	0.01	0.42***	0.18	0.37***
		(0.11)	(0.13)	(0.07)	(0.10)	(0.13)	(0.10)	(0.11)	(0.10)
Constant term		2.92***	4.67***	3.77***	5.01***	2.42***	2.94***	2.57***	3.50***
		(0.79)	(0.91)	(1.01)	(1.19)	(0.79)	(0.61)	(0.55)	(0.61)
Attribute variables		YES	YES	YES	YES	YES	YES	YES	YES

Note: Cluster robust standard errors at prefecture level in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Figure 1. Messages

Control group

- This vaccine has been shown to be **effective in preventing the onset of COVID-19.**
- In other words, vaccination can reduce the likelihood of you developing COVID-19 when you are infected.
- Vaccination may cause fever and pain and swelling in the vaccinated arm.
- In rare cases, adverse reactions of anaphylaxis may occur; however, it has been shown that these reactions are not a serious problem if handled appropriately. Vaccination sites in Japan are prepared to handle these reactions appropriately.

Treatment group A: *Comparison nudge*

(Top for older adults, Bottom for young adults)

- This vaccine has been shown to be **effective in preventing the onset of COVID-19.**
- In other words, vaccination can reduce the likelihood of you developing COVID-19 when you are infected.
- Vaccination may cause fever and pain and swelling in the vaccinated arm.
- In rare cases, adverse reactions of anaphylaxis may occur; however, it has been shown that these reactions are not a serious problem if handled appropriately. Vaccination sites in Japan are prepared to handle these reactions appropriately.

7-8 out of 10 people in your age group
answered they would receive this vaccine.

- This vaccine has been shown to be **effective in preventing the onset of COVID-19.**
- In other words, vaccination can reduce the likelihood of you developing COVID-19 when you are infected.
- Vaccination may cause fever and pain and swelling in the vaccinated arm.
- In rare cases, adverse reactions of anaphylaxis may occur; however, it has been shown that these reactions are not a serious problem if handled appropriately. Vaccination sites in Japan are prepared to handle these reactions appropriately.

6-7 out of 10 people in your age group
answered they would receive this vaccine.

Treatment group B: Influence-gain nudge

- This vaccine has been shown to be **effective in preventing the onset of COVID-19.**
- In other words, vaccination can reduce the likelihood of you developing COVID-19 when you are infected.
- Vaccination may cause fever and pain and swelling in the vaccinated arm.
- In rare cases, adverse reactions of anaphylaxis may occur; however, it has been shown that these reactions are not a serious problem if handled appropriately. Vaccination sites in Japan are prepared to handle these reactions appropriately.

The more people who receive this vaccine,
the more people who have an intention to do so.
Your vaccination behavior can encourage
the vaccination behavior of the people around you.

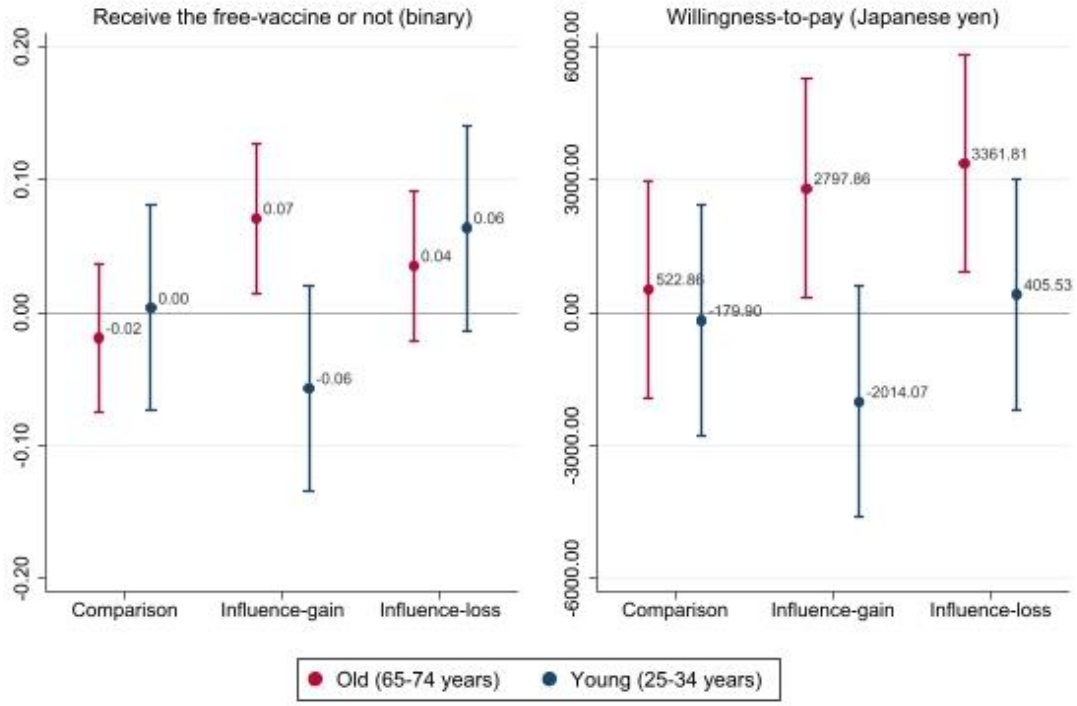
Treatment group C: Influence-loss nudge

- This vaccine has been shown to be **effective in preventing the onset of COVID-19.**
- In other words, vaccination can reduce the likelihood of you developing COVID-19 when you are infected.
- Vaccination may cause fever and pain and swelling in the vaccinated arm.
- In rare cases, adverse reactions of anaphylaxis may occur; however, it has been shown that these reactions are not a serious problem if handled appropriately. Vaccination sites in Japan are prepared to handle these reactions appropriately.

The more people who receive this vaccine,
the more people who have an intention to do so.
If you do not receive the vaccine,
the people around you also may not do so.

Figure 2. Vaccination Intention
(left for payment setting, right for receipt setting)

Figure 3. Message Effects on Vaccination Intention



Note: The numbers show the message effects, setting the control group as the baseline, while the bars show the 90% confidence interval.