Brief Report

How Can We Promote COVID-19 Vaccination? - Comparison of the Potential Influence between Opt-out and Opt-in Defaults

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Abstract: Vaccination is the key infection control measure against Coronavirus Disease 2019 (COVID-19). Most municipalities in Japan have adopted an opt-in system for COVID-19 vaccination, but its background information is limited. We, therefore, aimed to examine the differences in vaccination coverages and their cancellation rates between opt-in and opt-out settings for COVID-19 vaccination in 10 cities in A prefecture, Japan. 10 cities in A Prefecture were surveyed by email as of 10 October 2021 on the vaccination coverage by age group (12 years and older) and the cancellation rate on the day of vaccination. We also checked on the complaints received in the opt-out group. Opt-out was adopted in one of the ten cities in which vaccination was designed for all household members aged 15-64, thus serving as the opt-out group. Vaccination coverage in the opt-out group was 88.2%-89.2% for the first dose and 84.9%-86.0% for the second dose at 95% confidence intervals in the comparable 20–64-year age group. In contrast, the overall opt-in group (nine cities, one of which did not have an identified vaccination rate) was 51.3%-83.6% for the first dose and 63.5%-74.8% for the second dose in the same age group. For the opt-out group, the cancellation rate on the day was 11.3% for the first dose and 3.7% for the second dose, which had a lower cancellation rate than that of the opt-out on influenza vaccines in previous studies, 71%. Meanwhile, the opt-in group did not monitor them. There were no complaints about default changes in the opt-out group. While there is room for further research, such as understanding the reasons for accepting the default change by residents in the opt-out group, it was suggested that making opt-out the default would promote COVID-19 vaccination.

Keywords: COVID-19; Vaccination; Default; Opt-Out; Cancellation Rate

1. Introduction

Vaccination is the key infection control measure against Coronavirus Disease 2019 (COVID-19) [1,2]. However, not all targeted populations have been vaccinated [3], because of various reasons such as concerns about side effects, confusing schedules, and complicated procedures [4]. Mainly, "confusing schedule" and "complicated procedures" may cause people not to take the vaccination regardless of their willingness. People may put off or fail to take action even if the effort (frictional cost) required is small, thus requiring appropriate interventions [5].

Default change is one of the interventions mentioned in the intervention ladder [6], and is reported to be the nudge that has the significant impact on people's behavior change among the many nudges [7]. Nudge theory is a behavioral economic concept influencing the population's behavior and decision-making through choice architecture [8]. Although, recently, nudges are being implemented for COVID-19 vaccination [9], to our best knowledge, there have been no studies of COVID-19 vaccination promotion by changing their defaults.

In Japan, usually, local municipalities are responsible for providing vaccination information services to residents, and many of them adopt the opt-in system as their default. For example, 39 of

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the 40 municipalities in Aomori Prefecture use the opt-in system. While the opt-in system allows the target population to proactively decide the date, time, and place of vaccination, it also requires additional steps to complete the application process, and this frictional cost may cause some people not to take the vaccination, despite their willingness. The opt-out system has the potential to overcome such disadvantages from frictional costs [10], and with regard to COVID-19 vaccination, adopting a protocol designating the vaccination as the default, with a specified date, time, and place, with options to request a change, can be expected to improve vaccination rates. However, previous studies have reported that while the opt-out system for influenza vaccination increased vaccination rates compared to the opt-in (27% vs. 18%), the cancellation rate was higher (71% vs. 0%), which may be one reason for the opt-out not being the default in a vaccination strategy [11-13]. The COVID-19 vaccine is thawed 24 hours before the scheduled distribution and cannot be refrozen, so the high rate of same-day cancellations is a problem because it also increases the amount of vaccine waste.

However, regarding COVID-19 vaccination, information on the differences in vaccination and cancellation rates by different defaults and the population's response are still insufficient. Therefore, this study aimed to examine the differences in vaccination trends between opt-in and opt-out systems for COVID-19 vaccination.

2. Materials and Methods

Settings and Participants

This study focused on A Prefecture, which locates in the northern part of Honshu and has the second-highest rate of depopulation in Japan. In 2021, the percentage of its population aged 65 and over was 34.4% (national average 46.8%), and the increase in the aging rate up to 2045 is estimated to be the fastest [14,15]. The average life expectancy of men and women in A Prefecture was 78.67 and 85.93 years, respectively (the national average was 80.77 and 87.01 years, respectively), both of which are the shortest in Japan [16]. Moreover, the number of physicians per 100,000 population is 191.9, much lower than the national average (234.7), indicating limited medical resources in the prefecture, so effective measures are required for COVID-19 prevention.

In this study, 10 cities in A Prefecture were surveyed by email as of 10 October 2021 on the vaccination coverage by age group (12 years and older) and the cancellation rate on the day of vaccination (i.e., the percentage of people who made an appointment but did not show up at the vaccination sites on the day of vaccination without informing their cancellation by the day before). In addition, municipalities with opt-out systems were also asked about the number of complaints they received about their system. Of note, there are 30 other municipalities in A Prefecture, but their attitude to vaccination is not standardized, with some smaller towns and villages having administrative staff explaining vaccination directly to their residents. In contrast, cities with a relatively fixed population size are less likely to experience such variations; therefore, only city municipalities were included in this study. We set 10 October 2021 as the record date because the Japanese Government has announced that 90% of the population aged 12 and over could complete the two-dose vaccination scheme by this date [17].

The preliminary survey confirmed that 9 out of 10 cities had adopted opt-in and only city B had adopted a hybrid opt-in/opt-out system. In the nine opt-in cities, the available dates were indicated for each age group, and those who wanted to be vaccinated could apply individually by phone or online. City B also adopted an opt-in system for other vaccinations but implemented either opt-in or opt-out systems for the COVID-19 vaccine, splitting the target population into two groups. Of these, the opt-in system was designated for those with an urgent need (e.g., people working in hospitals, elderly care facilities, schools, and childcare facilities, police officers, third-year high school students, etc.), residents of suburban areas (areas included in the city as a result of a municipal merger) where the vaccination system at the clinic was quickly established, and 12-14-year-olds who required careful parental judgment; otherwise, the opt-out system was designated. The opt-in system in city B was similar to the application system in other cities. The opt-out system was designed to send vaccination tickets for all household members aged 15 and over, specifying the date, time, and place of

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vaccination all at once, and each person could request in advance if they did not wish to receive the vaccination or if they wanted to change their schedule.

Statistical Analysis

Although City B adopted an opt-in system for some citizen such as healthcare workers, these were excluded from the analysis because they may have particular motivations for vaccination. Cities other than City B were considered an opt-in group, and those eligible for opt-out in City B were considered an opt-out group. 95% confidence intervals were calculated for vaccination coverage in each municipality. Cancellation rates were compared between municipalities that had responded. IBM SPSS Statistics 24 (IBM Japan, Tokyo, Japan) was used for analysis.

Ethics

As this was a secondary analysis of vaccination data from local municipalities and no personal data was gathered in this study; therefore, there were no criteria to be reviewed by the university's ethics committee with which the first author is affiliated. When making inquiries, we informed each municipality in a written statement that the municipality's name would be anonymized before using them in our study. All cities publicized to their citizens that vaccination was not mandatory and informed them about the telephone consultation service for vaccines. In particular, in implementing the opt-out system, City B communicated to its citizens via public information magazines and social networking platforms to address their concerns and set up a contact point in case of confusion.

3. Results

All ten cities responded, and one city reported not knowing the vaccination coverage, so the remaining nine cities were included in the analysis. The opt-out group had a 95% confidence interval of 88.2%-89.1% for the first dose and 84.9%-86.0% for the second dose, while the opt-in group in total had an overall range of 81.4%-81.6% for the first dose and 69.0%-69.2% for the second dose, both of which were higher in the opt-out group. Moreover, when comparing the two groups in the comparable 20-64 age group, the opt-out group ranged from 88.2%-89.2% for the first and 84.9%-86.0% for the second dose, compared to 77.0%-77.3% for the first and 60.3%-60.6% for the second dose for the opt-in group as a whole.

Table 1 shows the vaccination coverage in each city.

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Table 1. Vaccination coverage rate

City	System	Dose		Total	95% Confidence Interval		20-64 age	95% Confidence Interval	
					Minimum	Maximum		Minimum	Maximum
B	Opt-out	1	Nominated Population	16,225			14,903		
			Vaccinated Population	14,385			13,215		
			Vaccination Coverage	88.7%	88.2%	89.1%	88.7%	88.2%	89.2%
		2	Nominated Population	16,225			14,903		
			Vaccinated Population	13,858			12,732		
			Vaccination Coverage	85.4%	84.9%	86.0%	85.4%	84.9%	86.0%
C	Opt-in	1	Nominated Population	255,534			137,471		
			Vaccinated Population	214,584			110,670		
			Vaccination Coverage	84.0%	83.8%	84.1%	80.5%	80.3%	80.7%
		2	Nominated Population	255,534			137,471		
			Vaccinated Population	190,501			93,857		
			Vaccination Coverage	74.6%	74.4%	74.7%	68.3%	68.0%	68.5%
D	Opt-in	1	Nominated Population	206,481			118,922		
			Vaccinated Population	164,389			89,470		
			Vaccination Coverage	79.6%	79.4%	79.8%	75.2%	75.0%	75.5%
		2	Nominated Population	206,481			118,922		
			Vaccinated Population	128,206			61,385		
			Vaccination Coverage	62.1%	61.9%	62.3%	51.6%	51.3%	51.9%
E	Opt-in	1	Nominated Population	153,075			87,354		
			Vaccinated Population	119,929			63,791		
			Vaccination Coverage	78.3%	78.1%	78.6%	73.0%	72.7%	73.3%
		2	Nominated Population	153,075			87,354		
			Vaccinated Population	99,856			48,219		
			Vaccination Coverage	65.2%	65.0%	65.5%	55.2%	54.9%	55.5%
F	Opt-in	1	Nominated Population	55,416			30,165		

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			Vaccinated Population	47,046			25,102		
			Vaccination Coverage	84.9%	84.6%	85.2%	83.2%	82.8%	83.6%
		2	Nominated Population	55,416			30,165		
			Vaccinated Population	42,220			21,736		
			Vaccination Coverage	76.2%	75.8%	76.5%	72.1%	71.6%	72.6%
G	Opt-in	1	Nominated Population	48,811			26,743		
			Vaccinated Population	40,390			20,623		
			Vaccination Coverage	82.7%	82.4%	83.1%	77.1%	76.6%	77.6%
		2	Nominated Population	48,811			26,743		
			Vaccinated Population	34,713			15,751		
			Vaccination Coverage	71.1%	70.7%	71.5%	58.9%	58.3%	59.5%
H	Opt-in	1	Nominated Population	34,846			21,549		
			Vaccinated Population	28,902			16,988		
			Vaccination Coverage	82.9%	82.5%	83.3%	78.8%	78.3%	79.4%
		2	Nominated Population	34,846			21,549		
			Vaccinated Population	25,167			14,510		
			Vaccination Coverage	72.2%	71.8%	72.7%	67.3%	66.7%	68.0%
I	Opt-in	1	Nominated Population	28,800			14,582		
			Vaccinated Population	23,319			11,111		
			Vaccination Coverage	81.0%	80.5%	81.4%	76.2%	75.5%	76.9%
		2	Nominated Population	28,800			14,582		
			Vaccinated Population	19,968			8,463		
			Vaccination Coverage	69.3%	68.8%	69.9%	58.0%	57.2%	58.8%
J	Opt-in	1	Nominated Population	28,020			15,463		
			Vaccinated Population	22,358			11,247		
			Vaccination Coverage	79.8%	79.3%	80.3%	72.7%	72.0%	73.4%
		2	Nominated Population	26,790			15,463		
			Vaccinated Population	19,256			9,457		

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		Vaccination Coverage	71.9%	71.3%	72.4%	61.2%	60.4%	61.9%
Opt-in total	1	Nominated Population	810,983			452,249		
		Vaccinated Population	660,918			349,002		
		Vaccination Coverage	81.5%	81.4%	81.6%	77.2%	77.0%	77.3%
	2	Nominated Population	809,753			452,249		
		Vaccinated Population	559,887			273,378		
		Vaccination Coverage	69.1%	69.0%	69.2%	60.4%	60.3%	60.6%

Table 2 shows the cancellation rate on the day in City B, as other cities did not record such information.Also, in the opt-out group, no complaints were received from residents about the implementation of the opt-out system. Of note, As stated earlier, since opt-in and opt-out subjects in City B have very different basic characteristics, we did not perform a statistical analysis of the difference between the two.

Table 2. No-show and cancellation rate on the day of the vaccination

	TOTAL	12-14	15-19	20-29	30-39	40-49	50-59	60-64	65-69	70-79	80-89	90-99	100 AND MORE
1ST OPT-IN	9.7%	14.6%	19.1%	18.8%	12.3%	10.3%	7.9%	6.7%	7.6%	7.2%	8.8%	11.3%	10.0%
1ST OPT-OUT	11.3%	—	11.5%	17.7%	13.5%	10.8%	8.9%	7.3%	—	—	—	—	—
2ND OPT-IN	10.5%	15.6%	21.5%	20.0%	13.5%	11.4%	9.0%	7.1%	8.0%	7.8%	9.3%	12.3%	12.5%
2ND OPT-OUT	14.6%	—	14.8%	22.6%	17.1%	14.0%	11.6%	9.4%	—	—	—	—	—

4. Discussion

COVID-19 vaccination coverage rates were higher in the opt-out group than in the opt-in group for all age groups of 15-64 years. This suggests a promotion of vaccination by default, in accordance with the findings of previous studies [11]. The previous study showed only an effect of a single dose of the vaccine [11]. In this study, however, there was a 9.2%-11.6% decrease in the second vaccination rate in the opt-in group compared to the first dose but only a 3.2% decrease in the opt-out group. These results suggest that an opt-out system may contribute to increased COVID-19 vaccination coverage among 15-64 year-olds and the improvement in the coverage may be sustained even with the second dose of the vaccine. In the opt-in group, vaccination coverage among 15–64-year-olds was generally lower than among those aged 65 and over, suggesting that 15–64-year-olds may be likely to feel the frictional cost of cumbersome vaccination application procedures. In some cases, the opt-in group had different vaccination dates for household members, and the transportation arrangements each time may have been a frictional cost.

The average vaccination coverage for the nine cities is calculated to be 70.5%.This rate is close to the average 68.3% for Japan as a whole at that time [18].Since data on the willingness of A residents for vaccination were not available, referring to published studies on the willingness of Japanese were 69.1% for those aged -19, 63.5% for 20-29, 64.5% for 30-39, 57.1% for 40-49, and 64.5% for 50-59 respectively [19]. Given this as a baseline, some municipalities in the opt-in group had vaccination rates lower than these rates. On the other hand, the opt-out group exceeded in both the first and second dose in all age groups. Therefore, it is assumed that nudges using opt-out default changes encouraged not only those who were willing to be vaccinated, but also some of those who were unsure whether to be vaccinated.

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Furthermore, the opt-out system in which household members were designated in batches presumably reduced frictional costs. Also, it has been reported that vaccination coverage increased significantly when the message in the COVID-19 vaccine information notice was phrased "[participant's first name], a COVID-19 vaccine has just been made available to you" [20]. This can be explained by inducing feelings of ownership over vaccines. The opt-outs may have stimulated similar feelings, as the notification provided a secured name as well as a date and a time frame.

Cancellation rates were unavailable except for City B, so comparisons between groups could not be conducted. However, the opt-out group had a lower cancellation rate than that of the opt-out on influenza vaccines in previous studies[11]. This study suggests that the cancellation rate on the vaccination day of the opt-out may be lower than the anticipation.

City B did not receive any complaints about their implementing an opt-out system. Considering the high vaccination coverage and low cancellation rates in the opt-out group and the fact that there were no complaints, it is reasonable to interpret the opt-out as having been accepted by the target population. Indeed, Japan is categorized as a 'nudge prudent country', with a lower level of support for the default nudges implemented by the government than other countries [21]. The municipalities that are more familiar with this are more likely to avoid introducing an opt-out system because of the anticipated backlash from their residents for changing their conventional approach. Therefore, it is meaningful because this study suggests that a default change may be acceptable in a nudge prudent country Japan.

However, in reality, it may be challenging to introduce an opt-out system immediately in opt-in groups. This is because municipalities do not know their baseline cancellation rates, and therefore, even if they understood the need for implementing an opt-out system, there would be no objective comparison of the benefits resulting from a change in default. It has been reported that people tend to make decisions influenced by status quo bias when they are fatigued [22]. Therefore, municipal officials, exhausted by the prolonged COVID-19 pandemic, may have been influenced by status quo bias and continued to adopt opt-in systems. In order to make the best decision, a cancellation rate visualization system should be established and then examined based on quantitative data. The results of this study are expected to contribute to this process.

This study has several limitations. First, the scale of infection rates varies from city to city; thus, it cannot be ruled out that this may impact vaccination coverage. As the number of outbreaks or infected cases by the city was not available, it was not possible to use them for the analysis. Second, we did not examine any disincentive to introducing opt-out systems other than the cancellation rate on the vaccination day. There may be other factors that may be causing disincentives. Third, we could not identify the reasons why the residents of the opt-out group accepted the default change. It will be necessary to identify the reasons for this in order to promote the system in other areas in the future. Fourth, as this study was conducted only in one region, we need to be careful in interpreting the results of this study. Further research, including qualitative research, is needed to overcome these limitations. Nevertheless, despite these limitations, this is a critical study that compares vaccination and same-day cancellation rates for different default methods of COVID-19 vaccination.

5. Conclusions

In conclusion, we examined vaccination rates by age group and same-day cancellation rates by opt-in and opt-out for 10 cities in Japan, as well as the number of complaints in the opt-out group. In the opt-out group, which defaulted the vaccination of all household members aged 15-64, vaccination coverage was higher than in the opt-in group, same-day cancellation rates were lower than in previous studies, and there were no complaints about implementing the opt-out system. Therefore, it was suggested that the adoption of opt-out system would promote COVID-19 vaccination. However, the lack of information on cancellation rates in the opt-in group can be a disincentive to introducing opt-out, so a system for visualization of the cancellation rate needs to be developed. In addition, this study has some limitations, such as not being able to identify why residents in the opt-apt group accepted the default change, thus requiring further research.

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