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Keio University School of Medicine

Understanding the Reasons Behind Reversals in COVID-19 Vaccination Hesitancy & Willingness

A One-Year Follow-Up Survey of 20,000 Participants

A research team at Keio University has conducted two large-scale national online surveys of Japanese adults aged 20 and older regarding COVID-19 vaccination willingness. The team was led by Project Associate Professor Shuhei Nomura and researcher Cyrus Ghaznavi of the Department of Health Care Policy and Management at the Keio University School of Medicine.

The first survey was conducted in February 2021, just before COVID-19 vaccinations became available to the general population in Japan; the second survey was conducted one year later in February 2022. The team analyzed data from approximately 20,000 respondents using multidimensional statistical methods and summarized the characteristics of those who had changed their minds regarding vaccination willingness during the past year.

The results of this study were published as two separate research papers in the British medical journal *The Lancet Regional Health - Western Pacific* on July 21, 2022 (BST).

1. Research Background

- The research team analyzed two separate groups of respondents based on their vaccination intentions during the first survey and published their findings in two papers. One paper (hereafter referred to as "Paper 1") analyzed those who responded in the first survey that they did not intend to vaccinate or were not sure whether or not to receive the vaccination but subsequently responded in the second survey that they were vaccinated or intended to be vaccinated. The other ("Paper 2") analyzed those who responded in the first survey that they intended to vaccinate but subsequently responded in the second survey that they were not sure whether or not to receive the vaccination or were unwilling to receive the vaccination.
- Paper 1 shows that while 8,077 participants responded “no” or “not sure” in the first survey regarding their intention to be vaccinated, 5,861 (72.6%) subsequently responded that they had received or were intending to receive the vaccine in the second survey (see figure below).
- The results of a cluster analysis¹ revealed five main themes characterizing those who changed their minds: (1) they perceived benefits of vaccination; (2) they knew someone who had received the vaccine; (3) they recognized the social significance of vaccination; (4) their concerns about short-term adverse reactions and safety were dispelled; and (5) they felt not getting vaccinated would impact their work and personal relationships. *However, characteristic (5) only applies to those who changed their mind from “no” to “vaccinated” or “intend to be vaccinated.”
- Paper 2 describes that while 11,118 responded “yes” in the first survey regarding their intention to be vaccinated, 434 (3.9%) subsequently responded in the second survey that they did not intend to vaccinate or were unsure whether to receive the vaccination.
- The results of a regression analysis² identified several characteristics of these individuals. These characteristics included: being unmarried; being in poor health; not having been vaccinated against influenza in previous years; having been previously infected with COVID-19; not having been

tested for COVID-19; not engaging in COVID-19 preventive measures; and the use of certain information sources (magazines, social media platforms, etc.).

- In order to succeed in concerted global vaccination promotion, further efforts to determine how to increase vaccine acceptance are needed. This study provides one piece of evidence for improving the effectiveness of future vaccination campaigns against COVID-19.
- Also, at the time of the second survey, respondents were asked their opinion regarding changes in activity restrictions depending on whether or not they had been vaccinated (or had proof of negative testing). 49.3% of those who had been vaccinated or planned to be vaccinated agreed with the changes, 9.1% were against them, and 41.7% were undecided. On the other hand, among those who responded in the second survey that they were unsure or did not intend to receive the COVID-19 vaccine, 9.6% were in favor of these changes, 44.5% were against them, and 45.8% were undecided.

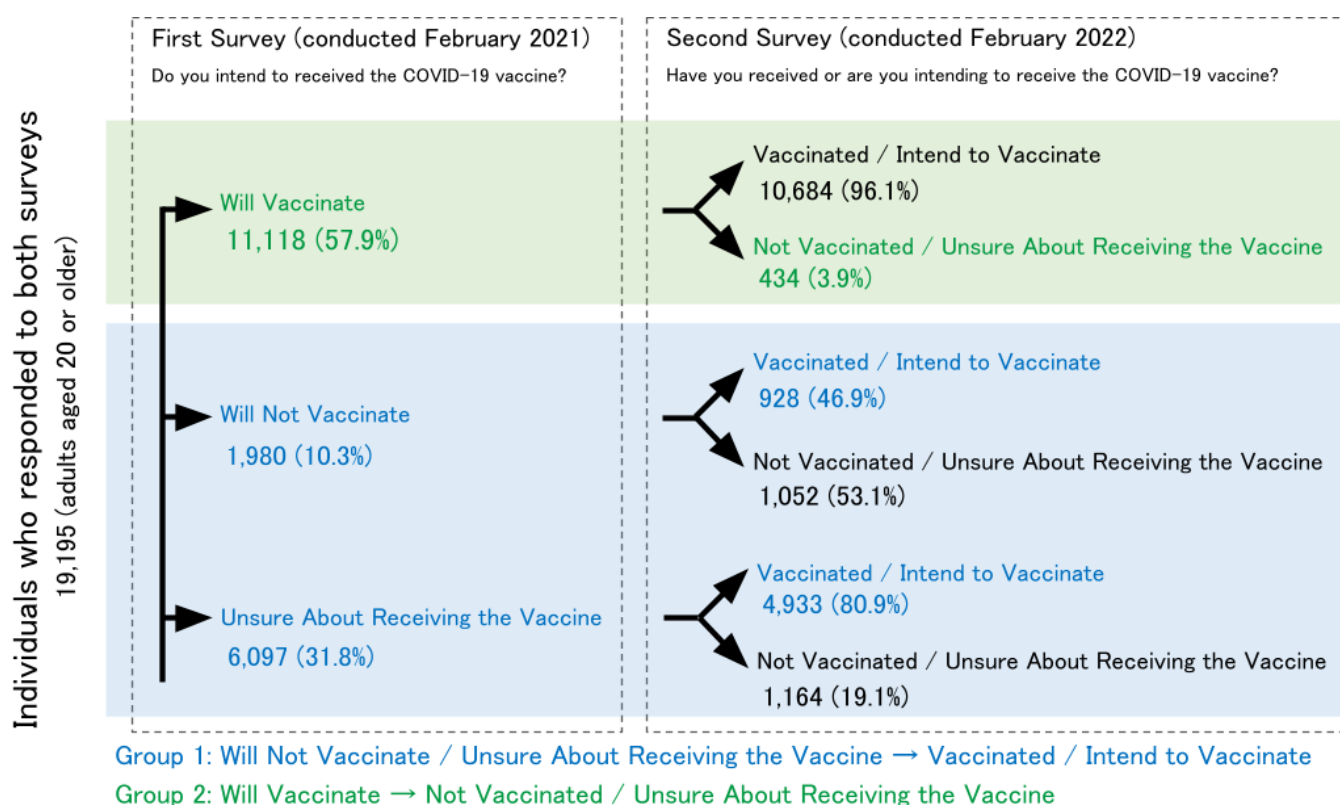


Fig. 1: Changes in COVID-19 Vaccination Willingness

2. Research Significance and Future Development

The Omicron variant, which has been spreading in Japan since the beginning of 2022, is highly contagious, and there is concern about the spread of infection and an increase in severe cases of COVID-19. Even in young people, cases can become severe and result in long-term symptoms after infection. Without a steady supply of effective treatments, vaccination is one of the most effective public health interventions to prevent and control COVID-19.

At the same time, raising vaccination rates is a major challenge worldwide. In Japan, general inoculations began around June 2021, and as of July 2022, 81% of the population had received a two-dose vaccination series, with 62% having received their third dose. These figures show that there is still room for improvement. The spread of infection is unpredictable, and it is necessary to continually promote vaccination.

This study identified the characteristics behind those who were initially vaccine-hesitant (Paper 1) as well as those who had intended to be vaccinated but later changed their minds (Paper 2). This evidence will provide an important intellectual foundation for promoting vaccination to those who are hesitant and for maintaining a positive attitude toward vaccination in the future.

Responses from 20,000 participants throughout Japan in a one-year follow-up survey

In this study, the research team conducted two large-scale national online surveys on vaccination willingness among Japanese adults aged 20 years or older. The first survey was conducted in February 2021, just before COVID-19 vaccinations became available to the general population, with the second follow-up survey conducted one year later in February 2022. At the time of the follow-up survey, which yielded 19,195 responses, third-dose vaccinations had just become available in Japan.

More than 70% changed their minds from “no” or “not sure” regarding their intention to be vaccinated

Paper 1 shows that while 8,077 participants responded “no” or “not sure” in the first survey regarding their intention to be vaccinated, 5,861 (72.6%) of these same individuals later responded that they had received or were intending to receive the vaccine in the second survey. Of the 1,980 who responded “no” regarding their intention to be vaccinated, 928 (46.9%) changed their minds, and of the 6,097 who responded “not sure” regarding their intention to be vaccinated, 4,933 (80.9%) changed their minds (see Fig. 1 above).

Five themes characterizing those who changed their minds about getting vaccinated

The results of a cluster analysis¹ identified sub-populations with similar patterns of survey responses and found that respondents could be divided into five clusters (six if those with no specific characteristics are included) characterized by the following themes: (1) they perceived benefits of vaccination; (2) they knew someone who had received the vaccine; (3) they recognized the social significance of vaccination; (4) their concerns about short-term adverse reactions and safety were dispelled; and (5) they felt not getting vaccinated would impact their work and personal relationships (see table below). *However, characteristic (5) only applies to those who changed their mind from “no” to “vaccinated” or “intend to be vaccinated.”

	Change from a “no” response (928 people)	Change from a “not sure” response (4,933 people)
(1) Perceived benefits of vaccination	13.2%	9.5%
(2) Knew someone who had received the vaccine	13.5%	4.2%
(3) Recognized the social significance of vaccination	29.4%	33.8%
(4) Concerns about short-term adverse reactions and safety were dispelled	18.3%	16.2%
(5) Felt not getting vaccinated would impact their work and personal relationships	5.4%	–
(6) No unique characteristics	20.2%	36.3%

Fig. 2: 5 Overarching reasons for changing one’s mind regarding their intention to be vaccinated from “unwilling to vaccinate” or “not sure” to “vaccinated” or “intending to vaccinate”

Some participants who first answered “will get vaccinated” changed their minds

Paper 2 describes that while 11,118 responded “yes” in the first survey regarding their intention to be vaccinated, 434 (3.9%) of these responded in the second survey that they did not intend to vaccinate or were unsure whether to receive the vaccination (see Fig. 2 above).

The factors involved in this change are primarily non-socioeconomic

In Paper 2, the research team used regression analysis² to identify several characteristics related to why respondents changed their minds regarding vaccination willingness. These included: being unmarried; being in poor health; not having been vaccinated against influenza in previous years; having been previously infected with COVID-19; not having been tested for COVID-19; not engaging in

COVID-19 preventive measures; and the use of certain information sources (such as magazines and social media platforms).

Vaccination is one of the most effective public health interventions to prevent and control COVID-19

Around the time vaccinations were first made available to the general population, a number of national and international studies were conducted to assess vaccination willingness and related factors. However, few studies conducted follow-up surveys as long as one year from the start of vaccination programs or evaluated the actual vaccination experience and subsequent changes in vaccine willingness. Even after vaccines were developed and began to be administered globally, the situation surrounding COVID-19 continued to evolve with the emergence of new variants, the weakening of vaccine efficacy, and the approval of new COVID-19 treatments. As a result, this study was able to determine that vaccination willingness has also changed significantly and identified the characteristics that underlie this change, based on the results of a large-scale survey of approximately 20,000 people.

One of the overarching reasons characterizing a reversal in vaccination hesitancy, “impact on work and personal relationships,” was not observed in those who changed their minds from “unsure,” while it was observed in those who changed their minds from “no” with respect to vaccination willingness. Recommendations in the workplace may promote vaccination among those who were firmly against vaccination initially. While some U.S. and Australian studies indicated that recommendations from healthcare professionals may have played an important role in changing people’s willingness to vaccinate against COVID-19, this study in Japan found no such connection. Looking at the unique characteristics of individuals who changed their minds, as detailed in this study, will promote a dialogue on how to encourage vaccination among those who are hesitant in the future.

In order to improve the vaccination rate, it is also important to reach out to the few percent of the population who initially planned to but ultimately decided not to be vaccinated. For example, the fact that this study found that previous COVID-19 infection and the use of certain information sources (such as magazines and certain social media platforms) were related to changes in attitude suggests that there is a need to reconsider public health messaging to certain subsets of the population.

Opinions on vaccine-and-test packages³ vary widely by vaccination status

Also, at the time of the second survey, respondents were asked their opinion regarding changes in activity restrictions depending on whether or not they had been vaccinated (or had proof of negative testing). 49.3% of those who had been vaccinated or planned to be vaccinated agreed with the changes, 9.1% were against them, and 41.7% were undecided. On the other hand, among those who responded in the second survey that they were unsure or did not intend to receive the COVID-19 vaccine, 9.6% were in favor of these changes, 44.5% were against them, and 45.8% were undecided.

While the use of such vaccinations and test certificates is supported by those who favor vaccination, some reports suggest that it may increase resistance to vaccination among those who were already hesitant about getting vaccinated. There needs to be a concerted outreach to those who are hesitant about being vaccinated, and vaccination and testing promotion efforts should be carefully designed to avoid increasing inequalities among those who are hesitant.

3. Notes

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4. Research Paper

Paper 1

Title : Characterising reasons for reversals of COVID-19 vaccination hesitancy among Japanese people: One-year follow-up survey

Authors : Shuhei Nomura, Akifumi Eguchi, Daisuke Yoneoka, Michio Murakami, Cyrus Ghaznavi, Stuart Gilmour, Satoshi Kaneko, Takayuki Kawashima, Hiroyuki Kunishima, Wataru Naito, Haruka Sakamoto, Keiko Maruyama-Sakurai, Arata Takahashi, Yoshihiro Takayama, Yuta Tanoue, Yoshiko Yamamoto, Tetsuo Yasutaka, Hiroaki Miyata

Publication : *The Lancet Regional Health – Western Pacific*

DOI : 10.1016/j.lanwpc.2022.100541

Paper 2

Title : Factors associated with reversals of COVID-19 vaccination willingness: Results from two longitudinal, national surveys in Japan 2021-2022

Authors : Cyrus Ghaznavi, Daisuke Yoneoka, Takayuki Kawashima, Akifumi Eguchi, Michio Murakami, Stuart Gilmour, Satoshi Kaneko, Hiroyuki Kunishima, Wataru Naito, Haruka Sakamoto, Keiko Maruyama-Sakurai, Arata Takahashi, Yoshihiro Takayama, Yuta Tanoue, Yoshiko Yamamoto, Tetsuo Yasutaka, Hiroaki Miyata, Shuhei Nomura

Publication : *The Lancet Regional Health – Western Pacific*

DOI : 10.1016/j.lanwpc.2022.100540

Glossary

¹ Cluster Analysis:

Cluster analysis is a statistical method used in this study to identify groups of people who have changed their minds from “no” or “not sure” to “received” or “intending to receive” regarding their willingness to be vaccinated and whose response patterns to the survey are similar. This method allows us to identify different sub-populations among the respondents. More technically, the research team used the Ordering Points To Identify the Clustering Structure (OPTICS) algorithm, which considers data as points in a multidimensional space, creating clusters based on high-density areas. The research team also used the Uniform Manifold Approximation and Projection (UMAP) dimensionality reduction technique to compress complex data into a two-dimensional representation.

² Regression Analysis:

Regression analysis is a statistical method used in this study to determine the association between a change of mind (a binary outcome variable) from “willing” to “unsure/unwilling” and various variables collected in the survey. More technically, the research team used the sparse group minimax concave penalty (MCP) to select the optimum group of covariates for the logistic regression, which takes into account the group structure of each variable and is useful in dealing with high dimensional data with a very large number of variables.

³ Vaccine-and-Test Package:

The Vaccine-and-Test Package system is designed to reduce the risk of infection by utilizing vaccination history or negative test results so that daily life and socioeconomic activities can be maintained while preventing the spread of infection. The system allows for the relaxation of restrictions on food establishments, public events, and travel under future states of emergency and priority measures to prevent the spread of the disease. (Description adapted from the Japanese-language "Q&A on the Overview of the Vaccine-and-Test Package System Ver. 1.3" published by the Japanese government)

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