Vaccination and altruism under the COVID-19 pandemic

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\textbf{ABSTRACT}

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\textbf{Objectives:} The goal of this study is to examine the role of altruism and sensitivity to public shame in individuals' willingness to pay for a COVID-19 vaccine.

\textbf{Study design:} We apply expected utility theory to predict the role of individuals' altruism and public shame in the willingness to pay for vaccines. Subsequently, we test the prediction by using a unique cross-sectional survey.

\textbf{Methods:} We use online survey data collected from those aged 30-49 in Japan between June 18th and 25th, 2020 (n = 1686). The selection of respondents follows quota sampling with regard to age group, gender, and prefecture of residence. We employ an ordinary least square (OLS) model to regress respondents' willingness to pay for a hypothetically-effective vaccine for COVID-19 on binary indicators of altruism and sensitivity to public shame, as well as socio-demographic characteristics.

\textbf{Results:} The willingness to pay for the vaccine is higher among those with stronger altruistic concerns and sensitivity to shaming.

\textbf{Conclusion:} Voluntary vaccinations may be inefficient, because the uptake of vaccines could be low for selfish individuals who often violate social distancing requirements. To improve the efficiency of vaccine uptake, some interventions, such as nudges and a vaccine passport, may be needed.

1. Introduction

Willingness to pay (WTP)—the maximum monetary value that a person will agree to pay for services or goods—has been used as a metric for public policymaking with respect to various economic and social problems [1]. The application of WTP to the uptake of COVID-19 vaccines may be a useful normative measure for the value that citizens place on reducing the individual and social effects of the virus, providing insights to our understanding of people's well-being under the pandemic [2]. This study examines the determinants of WTP for a hypothetical safe and effective vaccine for COVID-19. Specifically, we apply expected utility theory, a common framework for decision-making under risk, to argue that individuals' altruism and other social concerns can affect their WTP. We then use unique survey data from Japan to test the validity of our predictions.

2. Theoretical hypotheses

Our theoretical hypotheses are grounded in expected utility theory. Under the COVID-19 pandemic, unvaccinated individuals face two types of risks: symptomatic and asymptomatic infections. It is critical to distinguish these risks, because patients with asymptomatic infections do not have severe symptoms but can cause harm by spreading the COVID-19 virus to others. In broad terms, an individual's expected utility is determined by these two risk factors and financial wherewithal.

We consider a hypothetical situation, where individuals can completely remove both risks if they pay for and receive an effective vaccine. In this situation, WTP corresponds to the maximum amount they would agree to pay for the vaccine.

Let us consider how individuals' selfishness and altruism may affect their WTP. It is natural to assume that every individual wishes to avoid both risks and vaccines that reduce such risks to zero. However, the benefits from reducing the risk of asymptomatic infections may vary across individuals. For selfish persons, spreading COVID-19 to others does not affect their well-being. By contrast, altruistic persons will see the risk of spreading the virus as consequential for their family, community, and society, and they will consider it reasonable to pay some amount of

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money to protect others. Therefore, the WTP of altruistic individuals is expected to be higher than that of selfish individuals.

The underlying mechanism behind this hypothesis is related to the concept of “externality”. Because an individual’s infection can increase the probability of others’ infections, behavior that increases one’s own infection risk has a negative external effect on the well-being of others [3]. However, selfish individuals have little incentive to take costly actions that reduce the spread of infections, such as social distancing and vaccination, suggesting that collective action problems exist under the COVID-19 pandemic. Under such a situation, average levels of social distancing and vaccine become suboptimal. However, altruism, or motives to help and care for other people, can encourage individuals to take these preventative actions, mitigating the collective action problem.

Altruism is not the only psychological trait that can affect WTP for COVID-19 vaccines. In the context of externalities and public goods, one of the most important factors is sensitivity to public shaming, which works in a similar manner to altruism by incentivizing individuals to lower the risks of spreading the COVID-19 virus to others [4]. People who are sensitive to public shaming experience psychological/material costs from violating pro-vaccination social norms. Therefore, the WTP should be higher for individuals who are sensitive to public shaming than for those who are non-sensitive.

3. Empirical analysis

3.1. Method

We test our hypotheses using data from a nationally-representative online survey. Our survey was conducted between June 18th and 25th, 2020 (n = 1686) using Qualtrics. This was the third wave of a longer-running panel survey that started in March 2020. Respondents were recruited by Rakuten Insight, a Japanese survey company, which has 2.2 million registrants. Respondents were collected by quota sampling with regard to gender (two categories), age group (four 5-year categories, between 30 and 49), and location of residence (10 categories).

Respondents were directly asked for their WTP for a COVID-19 vaccine, as follows: how much would you pay for a hypothetical vaccine that can perfectly remove the risk of infection from COVID-19? At that time, vaccines were still under development and thus were purely hypothetical. The value of each respondent’s WTP (in Japanese Yen) is used as a dependent variable. We set the top-coding at 30,000 yen, which corresponds to the top 95 percentile of all responses. Our survey measured individuals’ altruism and sensitivity to shame using the following questions: (1) do you think it is important to help people around you and make them happy? and (2) do you think it is important to avoid doing anything people would say is wrong? Respondents chose their answer from five options (Yes, Weak Yes, Can’t Say, Weak No, No). We converted the raw responses into a binary measure, which took unity for those who chose Yes or Weak Yes, and zero otherwise. In our statistical analyses, we included control variables for subjective physical health (five-point scale), gender (female or not), income (Japanese Yen), age (continuous), education (graduated from a four-year university or not), and marital status (married or not). The summary statistics are reported in the Online Appendix (Table A1).

3.2. Empirical results

Fig. 1 shows the results of our full ordinary least square (OLS) model and demonstrates that altruism has a significantly positive effect on WTP (Table A2 shows the estimation results under different specifications; Fig. 1 depicts Model 4). Specifically, altruistic respondents are willing to...
pay ¥812 more for the vaccine. This observation is in line with previous studies showing that altruistic people tend to be more willing to accept vaccinations [5]. A similar effect can be found for sensitivity to shame; those who are sensitive are willing to pay ¥751 more.

4. Discussion and conclusion

Using unique survey data from Japan, this study found that those who are altruistic and sensitive to public shaming are value the COVID-19 vaccine more highly. If vaccination incurs monetary or non-monetary costs, then altruistic citizens will be more willing to be vaccinated than non-altruistic people. This tendency may be problematic, because earlier studies show that altruistic people are also more likely to follow social distancing measures.[6,7] Therefore, all other things being equal, their infection risk should be lower than that of non-altruistic people, even in the absence of effective vaccines. These arguments suggest that voluntary vaccinations may produce an inefficient outcome. In order to control the pandemic, reducing the infection risk of selfish people is socially more beneficial than reducing the risk of altruistic people, particularly during the early stages of vaccination when its supply is insufficient. Therefore, some weak or strong interventions by the government, such as nudges and vaccine passports (certificates), may be needed to improve the social effectiveness of vaccines.

Finally, we should note that our empirical analyses have the following limitations. First, the expected utility hypothesis assumes the rationality of individuals, but people have psycholgical biases and limitations in cognition. Indeed, it has been known that people’s behavior deviates from the expected utility hypothesis under certain economic/social situations [8]. Second, social concerns other than altruism and public shaming should also be considered [9]. Third, our respondents are limited in age and national context. Therefore, it is not guaranteed that similar observations hold for other age groups and countries. For example, in the UK, social/cultural standard may be different from Japan, and other mechanisms may drive WTP. Fourth, further studies are necessary to assess whether our findings are in line with individual decision making concerning actual vaccinations. Fifth, a tremendous flow of information, whose correctness is unknown, is an important feature under the COVID-19 pandemic [10]. Although such factors are not considered in this paper, it would be of interest to incorporate people’s media exposure into our analysis. We encourage further studies to address these issues.

Authors contributions

Cato (survey design, writing, data analysis); Iida (survey design, data collection); Ishida (survey design, data analysis); Ito (survey design, data interpretation); Katsumata (survey design, data interpretation); McElwain (survey design, writing, data interpretation); Shoji (survey design, writing, data analysis).

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhip.2022.100225.

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