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Health belief and behaviour: an analysis of the predictors for receiving COVID-19 vaccines in Malaysia

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Abstract

Purpose – The paper examines the 'Intention to Receive the COVID-19 Vaccines' or IRV from three perspectives: the health belief model, behavioural economics, and institutional quality.

Design/methodology/approach – This study provides quantitative analysis by applying Chi-squared test of contingencies, paired sample t-tests, exploratory factor analysis, and multiple linear regression (stepwise method) on the data collected from 591 respondents mainly from Malaysia.

Findings – The results show that Perceived Benefits, Perceived Barriers, Perceived Susceptibility, Herding, and Institutional Quality play roles as predictors of IRV. Perceived Benefits play the most crucial role among the predictors and Perceived Barriers is the least important predictor. People have the herding mentality after being exposed to information encouraging such behaviour.

Originality/value – This study reveals that the respondents changed their behaviour in different circumstances when exposed to information that incorporates the effect of herding. Herding mentality, the effectiveness of government authorities, and regulatory quality have become important factors in enriching public health policies and the effectiveness of interventions.

Keywords COVID-19, Intention to Receive Vaccine (IRV), Herding, Health belief model, Behavioural economics, Institutional quality

Paper type Research paper

Introduction

In December 2019, the first coronavirus disease 2019 (COVID-19) case appeared in Wuhan, China. Since then, it has spread worldwide, resulting in more than 6.38 million deaths (as of 27 July 2022) in 194 countries around the world which are member states of the World Health Organization (WHO, 2022a). As of December 2020, over 200 types of vaccines have been developed around the world to prevent infection of this virus (WHO, 2021). Only eleven of these 200 vaccines have been authorised by the World Health Organization (WHO). These vaccines are AstraZeneca with Oxford University, United Kingdom, BioNTech with Pfizer,

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USA, Gamaleya from Russia, Moderna from USA, Sinopharm with Beijing Institute, China, Covavax from Serum Institute of India, India, Novavax from USA, CanSino from China, Janssen from Johnson & Johnson, USA, Covishield from Serum Institute of India, India, Covaxin from Bharat Biotech, India and Sinovac Coronavac from China (WHO, 2022b). Although many vaccines are being developed, it is also important to ensure massive vaccination in society to generate herd immunity, which is the ultimate target to achieve in preventing the infection of this virus (Mercadante and Law, 2020; Paul *et al.*, 2021). Awareness about people's vaccination intentions and the factors that either support or discourage vaccination is crucial for achieving widespread immunisation. Based on this understanding, necessary steps can be taken by the relevant authorities in the country to increase vaccination uptake, such as improving public health communication by organising effective public health campaigns, etc. (Paul *et al.*, 2021; Ruiz and Bell, 2021). Knowing the predictors of people's IRV vaccines is essential.

The purpose of this research is to identify the predictors of the 'Intention to Receive COVID-19 Vaccines' (IRV). Various studies have been conducted to investigate these predictors. Other similar research includes Cerda and García (2021), Coulaud *et al.* (2022), Detoc *et al.* (2020), Eberhardt and Ling (2021), Hao and Shao (2022), Honora *et al.* (2022), Jacoby *et al.* (2022), Kitro *et al.* (2021), Kwok *et al.* (2021), Leng *et al.* (2021), Liao *et al.* (2022), Mercadante and Law (2020), Paul *et al.* (2021), Paul and Fancourt (2022), Ruiz and Bell (2021), Seddig *et al.* (2022), Tan *et al.* (2022), Urrunaga-Pastor *et al.* (2021), Wang *et al.* (2020) and Wong *et al.* (2021). Given that elderly people are the vulnerable ones and we should look across different educational levels, this research will not control the selection of samples and moderating effects because we are more concerned with understanding IRV in time with the introduction of different types of vaccines. This study is amongst the first to investigate whether information incorporating herding behaviour influences people to perceive institutional quality as one of the predictors of IRV. To the best of our knowledge, no other studies have conducted such research by taking herding and institutional quality into consideration of building a model of vaccination behaviour. The research is conducted based upon three perspectives, i.e., the health belief model (HBM), behavioural economics (herding, accessibility, etc.), and institutional quality.

Literature review

A health belief model was utilised to understand what influences people to receive the COVID-19 vaccines, given the severity of the pandemic which engulfed the world. In the context of this research, health belief models are important because they enable us to understand what influences the motivations and barriers of people in their health-related behaviours (Liora, 2021). Furthermore, this model has been utilised massively in vaccination studies, particularly in studies related to influenza vaccination (Liora, 2021). In comparison with other models, HBM was explicitly designed for health research related to the prevention of diseases. Since the 1950s, this model had been modified to be more inclusive and lean more toward interventions that improve health behaviours (Liora, 2021; Mercadante and Law, 2020). The most well-cited concepts are perceived susceptibility, severity, benefits, barriers, and cues to action and self-efficacy. The HBM also suggests that the factors be investigated include respondent characteristics, demographics and information that directly impact people's beliefs that lead to intention (Mercadante and Law, 2020). This research incorporates most of these concepts.

Aside from HBM, the behavioural economics perspective is also important to be incorporated into this research survey. One significant aspect of behavioural economics shows that people are likely to utilise social information from others, i.e. social proofing (Duffy *et al.*, 2021). This type of behaviour is called herding, which is defined as following

what others are doing, even if the private information people possess suggests that they should be doing something else (Banerjee, 1992). Herding also can arise when an informational cascade exists. An informational cascade happens when it is optimal to mimic the behaviour of others without considering one's information after knowing what others are doing (Bikhchandani *et al.*, 1992). Social pressure or herding mentality exists among people, encouraging them to follow the masses (Gradinaru, 2014). The herding mentality is also likely to reduce regret and provide a sense of comfort among people (Muradoglu, 2010). A good example of this herding mentality is the consequence of the COVID-19 pandemic on the European capital markets. As a result of the COVID-19 pandemic, herding behaviour exists in these markets as less informed investors follow well-informed ones (Espinosa-Méndez and Arias, 2021). This research proposes that the herding mentality also exists among people's intention to get vaccinated with the COVID-19 vaccines.

Another important aspect of behavioural economics that is incorporated into our survey is people's response to the accessibility and affordability of the COVID-19 vaccines. Accessibility is important as without adequate accessibility, there will not be massive vaccination to generate herd immunity. Affordability of the COVID-19 vaccines is equally important as 85 percent of the global population originates from low-income and middle-income countries (Wouters *et al.*, 2021). Respondents' perception of the affordability of the vaccine is crucial because people's acceptance of vaccination is likely to be high if vaccines are made affordable or fully subsidised by the government. Concerning this, the pricing of COVID-19 vaccines is extremely important (Wouters *et al.*, 2021).

Another critical perspective incorporated in this research survey is institutional quality, which comprises six indicators, i.e. voice and accountability, political stability and peace, the effectiveness of government authorities, regulatory quality, the rule of law, and control of corruption (Kaufmann *et al.*, 2008; Law and Azman-Saini, 2012; Matemilola *et al.*, 2019). We argued that without good institutional quality, society would have a negative or poor perception of how the COVID-19 vaccines will be managed and delivered to the citizens of the country, thus reducing the confidence of the people to undertake vaccination. For example, if the effectiveness of government authorities in handling this COVID-19 pandemic is poor and if the rule of law of the country is weakly implemented as well as corruption is rampant, the quality of the COVID-19 vaccines delivered may be compromised, and the relevant authorities may cover up any detrimental side effects of the COVID-19 vaccines. An excellent example to demonstrate the poor implementation of the rule of law is the case of Malaysia, where certain politicians escape the brunt of the law by violating the standard operating procedures (SOPs) and lockdown rules of COVID-19. In contrast, ordinary citizens must pay heavy fines or jail terms if caught violating these SOPs and rules (Sukumaran, 2020). Poor implementation of the rule of law may reduce the confidence of the survey respondents to accept COVID-19 vaccination. This study incorporates these institutional quality indicators except political stability and peace.

Based on the health belief model that has been used for studies related to health behaviour in vaccination, we added the behavioural economics concepts of herding and accessibility, and institutional quality to better estimate the IRV. Figure 1 depicts the conceptual framework of this research.

Research methodology

This research employed a quantitative survey using Google form to collect responses from people worldwide. Due to the urgency and unique situation of the COVID-19 outbreak, we have employed convenience sampling and snowball sampling methods to collect responses during the pandemic. These non-probability sampling methods are deemed suitable, especially during the pandemic. The researchers sent out the questionnaire to respondents

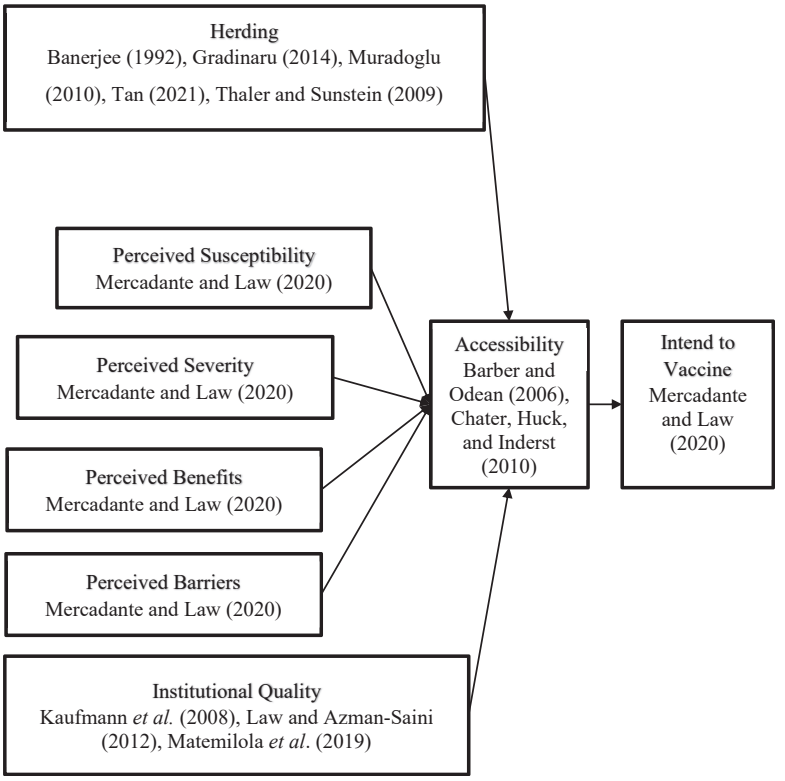

Figure 1.
Conceptual framework

through emails, social media platforms such as Facebook, LinkedIn, and researchers' contacts. The data collection started from 1 December 2020 to 15 January 2021. The questionnaire consists of three sections, and it took approximately 15 minutes for each respondent to complete the survey. The first section contains questions related to the background of respondents such as gender, age, marital status, number of children, employment, education level, ethics, area and country of residence, and the likelihood of taking a vaccine against COVID-19 infection when it is available in the market, etc.

Table 1 shows the items of measurement of the intention to undertake vaccination based upon the health belief model, behavioural economics, and institutional quality perspectives. The questionnaire employed a 10-point Likert scale to obtain a more quantifiable result. The scales are represented as 1 for strongly disagree to 10 for strongly agree. The following statement:

> Based on a recent survey conducted in Malaysia, more than 90 percent of the respondents have the intention to take the vaccine when it is available in the market.

was stated before respondents were asked again about their intention to get vaccinated. The purpose of this statement was to assess the availability of information and the occurrence of herding behaviour as a means of altering respondents' vaccination intentions. The statistic of 90 percent is gathered from a recent study conducted by Wong *et al.* (2021).

The second section asked the respondents to provide feedback regarding their decision making in receiving COVID-19 vaccines. The third section focuses on the influence of

Label of items	Measurements
Herding 1	I follow others' choice in taking the COVID-19 vaccine.
Herding 2	I am more likely to take the vaccination if a lot of people are going to take it.
Herding 3	I prefer to follow the decision of my family members and friends.
Perceived Susceptibility 1	My chance of getting COVID-19 in the next few months is great.
Perceived Susceptibility 2	I am worried about the likelihood of getting COVID-19.
Perceived Susceptibility 3	Getting COVID-19 is currently a possibility for me.
Perceived Susceptibility 4	I will always be at risk for getting COVID-19.
Perceived Severity 1	Complications from COVID-19 are serious.
Perceived Severity 2	I will be very sick if I get COVID-19.
Perceived Severity 3	I am afraid of getting COVID-19.
Perceived Benefits 1	Vaccination is good idea because it makes me feel less worried about catching COVID-19.
Perceived Benefits 2	Vaccination decreases my chance of getting COVID-19 or its complications.
Perceived Benefits 3	Having myself vaccinated protects me from COVID-19.
Perceived Benefits 4	Having myself vaccinated protects the public from COVID-19.
Perceived Benefits 5	Vaccination prevents the economic and labour losses due to COVID-19.
Perceived Benefits 6	Vaccine developed for COVID-19 have gone through comprehensive research and investigation.
Perceived Benefits 7	I would rather spend on the vaccine now than getting infected by COVID-19 later.
Perceived Barriers 1 (effectiveness and safety)	Worry the possible side-effects of COVID-19 vaccination would interfere my usual activities.
Perceived Barriers 2 (effectiveness and safety)	I am concern about the efficacy of the COVID-19 vaccination.
Perceived Barriers 3 (effectiveness and safety)	I am concern about the safety of the COVID-19 vaccination.
Perceived Barriers 4 (effectiveness and safety)	I think that some ingredients in the vaccine may negatively affect my health.
Perceived Barriers 5 (informative and cost)	I am concern of my affordability (high cost) of getting the COVID-19 vaccination.
Perceived Barriers 6 (informative and cost)	I do not have any information about the vaccine (such as where, when, and how this vaccine is administered).
Perceived Barriers 7 (informative and cost)	Cost of vaccination influences my decision to receive vaccination of the COVID-19 vaccine.
Intend to Vaccine 1	I will take the vaccination to protect myself
Intend to Vaccine 2	I want to take the vaccination for the benefits of myself and the public.
Intend to Vaccine 3	I intend to take the vaccination to decrease the chance of getting COVID-19.
Institutional Quality 1	The amount of opportunity to provide feedback on the COVID-19 vaccine influence my decision to receive vaccination of the COVID-19 vaccine.
Institutional Quality 2	The accountability of my government of any side effects as a result of the COVID-19 vaccination influences my decision to receive vaccination of the COVID-19 vaccine.
Institutional Quality 3	The political stability of my country influences my decision to receive vaccination of the COVID-19 vaccine.
Institutional Quality 4	The effectiveness of my government in handling and managing the COVID-19 pandemic influence my decision to receive the vaccination.
Institutional Quality 5	The regulations imposed by my country to prevent the infection of COVID-19 as well as the effectiveness of the legal enforcement influence my decision to receive the vaccination.
Institutional Quality 6	The effort exerted by my government to control corruption influence my decision to receive vaccination of the COVID-19 vaccine.

Table 1.
Items of measurement

institutional quality on receiving COVID-19 vaccination. The data were coded upon the completion of data collection, and several quantitative analysis techniques were used to compute the results. Exploratory factor analysis and reliability tests were used to categorise the variables into latent behavioural factors. Cronbach's alpha test for internal consistency was conducted to examine the inter-correlation of variables within each factor. Hence, this paper presented the results using exploratory factor analysis, reliability, paired sample t-tests, and multiple linear regression analysis. Besides SPSS Statistics, this paper also utilised Microsoft Excel to complete the data analysis and present the results.

Quantitative analysis

Demographic profiles

This section discusses the demographic profile of the respondents. In total, 591 survey forms were analysed (Tables 2 and 3). The respondents comprised 54.1 percent females and 45.6 percent males. There is higher participation in the age group under 45 years old (69.5 percent), no children (63.5 percent), Asian (87.0 percent), city (78.0 percent), and Malaysian (78.3 percent). Only a small proportion reported their health status as poor (0.7 percent) and 31.1 percent reported that they knew someone infected with COVID-19. Pearson's chi-square test of contingencies (with $\alpha = 0.05$) was also used to evaluate whether the demographic attributes are related to whether the participants intend to take COVID-19 vaccination. The chi-squared tests are statistically significant for attributes such as age group, marital status, occupation, number of children, education, and race/ethnicity/origin. However, the associations are quite small, denoted by *Cramer's V* in Table 2.

Factor analysis and reliability test

Factor analysis is a well-known statistical method used in reducing a huge number of measured variables into a smaller number of factors. There are 591 responses collected and factor analysis was applied. The questionnaire contains 34 variables and factor analysis was applied to identify the cluster and, in the end, 33 variables are used. With the potential existence of a correlation between the factors, exploratory factor analysis is conducted by employing principal component analysis and the oblique rotation method. The results of the first round of analysis suggest that it is factorability, where the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.921 and Barlett's test of sphericity is significant ($\chi^2(528) = 15294.392$, $p = 0.000$). It is significant to group the variables into seven components. These seven components have eigenvalues of more than 1, which explained 65.864 percent of the variance. The seven components which comprise the factor analysis are Herding, Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Institutional Quality, and IRV.

By using Cronbach's Alpha Internal Consistency method, the study achieved Cronbach's alpha of more than 0.70 for each factor. Table 4 presents the rotated factor pattern with the corresponding Cronbach's alpha.

Table 4 shows that Cronbach's alphas for the determinants are all more than 0.70. Although the preliminary factor analysis indicated that Perceived Barriers shall be separated into two different components, Cronbach's alpha showed a better internal consistency as one component. Table 5 presents the correlation among construct scores to identify the predictors of IRV.

As shown in Table 5, there is a very strong relationship between IRV and Perceived Benefits (0.847). Perceived Barriers seem to have a very weak relationship with the IRV (0.114). The other constructs which have a moderate to a weak relationship with IRV, include Herding, Perceived Susceptibility, Perceived Severity, and Institutional Quality.

Demographic Attributes	Overall N (%)	Intention to take COVID-19 vaccines: Do not intend (definitely not/ probably not) n = 88 (14.9%)	Intend (Maybe/Probably yes/ Yes, definitely) n = 503 (85.1%)
Gender[m]			
Male	267 (45.6)	41 (15.4)	226 (84.6)
Female	317 (54.1)	44 (13.9)	273 (86.1)
Other	2 (0.3)	1 (50)	1 (50)
		$\chi^2(2, 586) = 2.252$, *Cramer's V* $= 0.062$, $p = 0.324$	
Age group (Years)			
18 – 24	151 (25.5)	10 (6.6)	141 (93.4)
25 – 34	138 (23.4)	17 (12.3)	121 (87.7)
35 – 44	122 (20.6)	17 (13.9)	105 (86.1)
45 – 54	96 (16.2)	15 (15.6)	81 (84.4)
55 – 64	63 (10.7)	21 (33.3)	42 (66.7)
65 – 74	16 (2.7)	5 (31.3)	11 (68.8)
75 years and above	5 (0.8)	3 (60.0)	2 (40.0)
		$\chi^2(6, 591) = 37.311$, *Cramer's V* $= 0.21$, $p = 0.000$***	
Marital status			
Single	306 (51.8)	31 (10.1)	275 (89.9)
Married	258 (43.7)	47 (18.2)	211 (81.8)
Divorced	15 (2.5)	5 (33.3)	10 (66.7)
Widowed	7 (1.2)	2 (28.6)	5 (71.4)
Others	5 (0.8)	3 (3.3)	2 (0.4)
		$\chi^2(8, 591) = 30.281$, *Cramer's V* $= 0.226$, $p = 0.000$***	
Number of children			
No children	375 (63.5)	43 (11.5)	332 (88.5)
One child	63 (10.7)	11 (17.5)	52 (82.5)
Two children	90 (15.2)	19 (21.1)	71 (78.9)
Three children	34 (5.8)	7 (20.6)	27 (79.4)
Four children	22 (3.7)	5 (22.7)	17 (77.3)
Five or more children	7 (1.2)	3 (42.9)	4 (57.1)
		$\chi^2(5, 591) = 12.803$, *Cramer's V* $= 0.147$, $p = 0.025$**	
Occupation category			
Professional	173 (29.3)	30 (17.3)	143 (82.7)
Management	78 (13.2)	14 (17.9)	64 (82.1)
Administrative Staff	37 (6.3)	2 (5.4)	35 (94.6)
Support Staff	22 (3.7)	1 (4.5)	21 (95.5)
Consultant	22 (3.7)	4 (18.2)	18 (81.8)
Researcher	43 (7.3)	4 (9.3)	39 (90.7)
Self-employed/Partner	58 (9.8)	13 (22.4)	45 (77.6)
Student	129 (21.8)	14 (10.9)	115 (89.1)
Other	29 (4.7)	6 (20.7)	23 (79.3)
		$\chi^2(26, 591) = 40.491$, *Cramer's V* $= 0.262$, $p = 0.035$**	
Highest education level			
Primary/Elementary	4 (0.7)	0 (0.0)	4 (100.0)
Secondary/High	41 (6.9)	11 (26.8)	30 (73.2)
Tertiary	236 (39.9)	21 (8.9)	215 (91.1)
Postgraduate	293 (49.6)	53 (18.1)	240 (81.9)
Other	17 (2.9)	3 (17.6)	14 (82.4)
		$\chi^2(14, 591) = 33.960$, *Cramer's V* $= 0.240$, $p = 0.002$***	
Race, ethnicity, origin			
American Indian or Alaska Native	3 (0.5)	0 (0.0)	3 (100.)
Asian	514 (87.0)	67 (13.0)	447 (87.0)
Black or African American	12 (2.0)	6 (50.0)	6 (50.0)

Table 2.
Demographics of respondents compared with Intention to take COVID-19 vaccines

(*continued*)

Demographic Attributes	Overall N (%)	Intention to take COVID-19 vaccines: Do not intend (definitely not/ probably not) n = 88 (14.9%)	Intend (Maybe/Probably yes/ Yes, definitely) n = 503 (85.1%)
Hispanic, Latino or Spanish origin	5 (0.8)	0 (0.0)	5 (100.0)
Middle Eastern or North African	11 (1.9)	3 (27.3)	8 (72.7)
Native Hawaiian or Other Pacific Islander	1 (0.2)	0 (0.0)	1 (100.0)
White	34 (5.8)	11 (32.4)	23 (67.6)
Some other race, ethnicity, or origin	11 (1.9)	1 (9.1)	10 (90.9)
		$\chi^2(7, 591) = 24.447$, *Cramer's* $V = 0.203$, $p = 0.001$***	
Area			
City	461 (78.0)	63 (13.7)	398 (86.3)
Town	114 (19.3)	22 (19.3)	92 (80.7)
Village or rural area	16 (2.7)	3 (18.8)	13 (81.3)
		$\chi^2(2, 591) = 2.481$, *Cramer's* $V = 0.065$, $p = 0.289$	
Overall health status			
Very good	181 (30.6)	27 (14.9)	154 (85.1)
Good	345 (58.4)	51 (14.8)	294 (85.2)
Fair	61 (10.3)	10 (16.4)	51 (83.6)
Poor	4 (0.7)	0 (0.0)	4 (100.0)
		$\chi^2(3, 591) = 0.812$, *Cramer's* $V = 0.037$, $p = 0.847$	
Known any friends and family, neighbours, and colleagues infected by COVID-19			
Yes	184 (31.1)	30 (16.3)	154 (83.7)
No	407 (68.9)	58 (14.3)	349 (85.7)
		$\chi^2(1, 591) = 0.422$, *Cramer's* $V = 0.027$, $p = 0.516$	
Nationality			
Malaysia	463 (78.3)	60 (13.0)	403 (87.0)
Non-Malaysian	128 (21.7)	28 (21.9)	100 (78.1)
		$\chi^2(1, 591) = 6.290$, *Cramer's* $V = 0.103$, $p = 0.012$**	

[m] missing data
*** $p < 0.01$, ** $p < 0.05$, *$p < 0.10$.

Table 2.

This study also sought to determine whether a herd mentality exists in the decision-making process and the effect of information accessibility on IRV. As mentioned above, participants were first asked about the likelihood of taking the vaccine if the vaccine is available on the market. After they provided their feedback on the predictors of vaccination, a statement comprising the information on the percentage of respondents who have the intention to take the vaccine in a recent study was presented to the participants. With that, we examine whether there is a significant difference in the score using a paired sample t-test. Table 6 depicts the mean scores of IRV before and after the presentation of the statement. This difference is statistically significant, t (590) = 1.766, $p < 0.10$, with a mean difference of 0.12183 and a standard deviation of 1.67720.

With the aim to further investigate the predictors of the Intention to Receive COVID-19 vaccines, a multiple linear regression analysis (stepwise method) was conducted. The analyses on the histogram of regression standardised residual, skewness, and kurtosis were conducted to ensure that the assumptions of multiple linear regression and expectation of normal distribution are fulfilled. Five out of six factors are significant predictors of intention to get a vaccine, whether with or without the accessibility statement.

Country/Region	Frequency	Percentage (%)	Country/Region	Frequency	Percentage (%)
Afghanistan	1	0.17	Maldives	3	0.51
American Samoa	1	0.17	Malta	1	0.17
Antarctica	1	0.17	Mexico	5	0.85
Australia	5	0.85	New Zealand	2	0.34
Bangladesh	5	0.85	Oman	1	0.17
Bosnia and Herzegovina	1	0.17	Pakistan	1	0.17
Botswana	2	0.34	Philippines	2	0.34
Brunei	1	0.17	Portugal	1	0.17
Cambodia	8	1.35	Russia	1	0.17
Canada	1	0.17	Saudi Arabia	1	0.17
China	17	2.88	Singapore	5	0.85
Croatia	1	0.17	Spain	1	0.17
Egypt	2	0.34	Sri Lanka	1	0.17
France	11	1.86	Switzerland	1	0.17
Germany	1	0.17	Tanzania	2	0.34
Hong Kong SAR	3	0.51	Thailand	3	0.51
India	5	0.85	Ukraine	2	0.34
Indonesia	6	1.02	United Kingdom	9	1.52
Japan	5	0.85	United States	8	1.35
Malaysia	463	78.34	Uzbekistan	1	0.17
$N = 591$					

Table 3.
Residing country of respondents

A significant regression equation is found (F (5, 586) = 216.123, p = 0.000), with an R^2 of 0.596. Table 7 presents the overall results of multiple linear regression using data collected before exposing the participants to the statement regarding the accessibility of information and herding. In this analysis using standardized beta coefficients, it was found that Perceived Benefits (t = 21.593, p = 0.000, beta = 0.694) played the most important role in affecting IRV, then followed by Perceived Barriers (t = -4.904, p = 0.000, beta = - 0.135), Herding (t = 3.444, p = 0.001, beta = 0.109), and Perceived Susceptibility (t = 2.203, p = 0.028, beta = 0.065). Perceived Barriers is a predictor that has a negative association with the intention to receive a vaccine (unstandardised coefficient B in negative sign). This implies that the higher the scores of Perceived Barriers, the lower the IRV.

The analysis was repeated using a new IRV score after the participants are being informed that there were more than 90 percent of the respondents in a recent survey possess the intention to take the vaccine. A significant regression equation is found (F (3, 587) = 521.171, p = 0.000), with an improved R^2 of 0.727. Table 8 presents the overall results of multiple linear regression. In this analysis using standardized coefficients of beta, Perceived Benefits is still the most important factor in affecting IRV (t = 35.445, p = 0.000, beta = 0.814), then followed by Institutional Quality (t = 3.444, p = 0.001, beta = 0.109) and Perceived Barriers with negative association (t = -4.904, p = 0.000, beta = -0.059). It is observed that the negative association between Perceived Barriers and IRV becomes weaker. Besides, the effect of Herding becomes insignificant (compared to results in Table 7) when we have the statement that incorporates the impact of herding and the accessibility of information. Institutional Quality turned out to be a significant predictor now.

Discussion

Hwang (2020) suggests that mechanisms that lead to vaccination behaviour are especially important during this pandemic. The evaluation of health information sources is related to vaccine uptake. Chowdhury *et al.* (2021) highlighted widespread misinformation during

Determinants	1	2	3	4	5	6	7
Herding 1	0.772						
Herding 2	0.673						
Herding 3	0.570						
Perceived Susceptibility 1		0.630					
Perceived Susceptibility 2		0.326					
Perceived Susceptibility 3		0.894					
Perceived Susceptibility 4		0.650					
Perceived Severity 1			0.612				
Perceived Severity 2			0.719				
Perceived Severity 3			0.729				
Perceived Benefits 1				0.829			
Perceived Benefits 2				0.871			
Perceived Benefits 3				0.873			
Perceived Benefits 4				0.842			
Perceived Benefits 5				0.763			
Perceived Benefits 6				0.648			
Perceived Benefits 7				0.743			
Perceived Barriers 1 (effectiveness and safety)					0.716		
Perceived Barriers 2 (effectiveness and safety)					0.896		
Perceived Barriers 3 (effectiveness and safety)					0.868		
Perceived Barriers 4 (effectiveness and safety)					0.567		
Perceived Barriers 5 (informative and cost)					0.673		
Perceived Barriers 6 (informative and cost)					0.305		
Perceived Barriers 7 (informative and cost)					0.821		
Intend to Vaccine 1						0.844	
Intend to Vaccine 2						0.869	
Intend to Vaccine 3						0.850	
Institutional Quality 1							0.538
Institutional Quality 2							0.613
Institutional Quality 3							0.656
Institutional Quality 4							0.838
Institutional Quality 5							0.768
Institutional Quality 6							0.796
Cronbach's alpha	0.841	0.781	0.809	0.944	0.823	0.972	0.889

Table 4.
Rotated factor pattern and Cronbach's alpha for vaccination decision

	Herding	Perceived Susceptibility	Perceived Severity	Perceived Benefits	Perceived Barriers	Institutional Quality	Intention to Vaccine
Herding	1.000						
Perceived Susceptibility	0.303***	1.000					
Perceived Severity	0.262***	0.492***	1.000				
Perceived Benefits	0.501***	0.424***	0.480***	1.000			
Perceived Barriers	0.290***	0.164***	0.314***	0.144***	1.000		
Institutional Quality	0.507***	0.172***	0.263***	0.343***	0.469***	1.000	
Intention to Vaccine	0.482***	0.389***	0.418***	0.847***	0.114***	0.372***	1.000

*** $p < 0.01$, ** $p < 0.05$, *$p < 0.10$.

Table 5.
Correlation among construct scores

large-scale infectious disease outbreaks since 2000, where conspiracy theories are also part of the misinformation, especially on vaccination. The methods we deliver health information are important in determining the success rate of vaccination uptake and public health intervention programs. From the study of Lu *et al.* (2020), it is apparent that American and Chinese people have different sources preferences and how they seek health information showed that the accessibility of information is different across populations and cultural backgrounds. Besides, we shall not ignore the role of audience involvement and a sense of affinity for a celebrity in promoting healthy behaviours (Kresovich and Noar, 2020).

In the context of promoting herd immunity during the pandemic, this study revealed that nudges on the positive responses of others towards COVID-19 vaccination (i.e. providing accessibility of information to the respondents with regards to the positive responses of others) influence IRV. This indicates the significance of herding behaviour and nudging in public health interventions. The findings are consistent with Sasaki *et al.* (2022), who found that nudges about the information of others on COVID-19 vaccines can positively influence IRV without hindering their independent decision-making.

In addition, the findings are also consistent with Mouter *et al.* (2022) who found that people's IRV are higher when they know about the experience of others with this vaccination. As per results shown in the above session, herding played a significant impact on IRV.

Table 6.
Statistical Test using Paired Sample t-tests to test for differences

Constructs	Mean (without)	Mean (with)	t-stat	Sig.
Intention to Vaccine	7.6277	7.5059	1.766	0.078*

*** $p < 0.01$, ** $p < 0.05$, *$p < 0.10$.

Table 7.
Multiple Linear Regression Results for IRV (without the accessibility statement)

Regression Statistics	
Multiple R	0.772
R Square	0.596
Adjusted R Square	0.593
Standard Error	1.61135
Observations	591

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	5	2244.594	561.148	216.123	0.000
Residual	586	1521.511	2.596		
Total	590	3766.105			

	Unstandardised Coefficients B	*Standard Error*	*Standardise Coefficients* Beta	*t Stat*	*P-value*
Intercept	1.990	0.329		6.045	0.000
Perceived Benefits	0.814	0.038	0.694	21.593	0.000
Perceived Barriers	-0.186	0.038	-0.135	-4.904	0.000
Herding	0.106	0.031	0.109	3.444	0.001
Perceived Susceptibility	0.077	0.035	0.065	2.203	0.028

Dependent variable: Intention to Receive (without accessibility statement)

Regression Statistics					
Multiple R	0.853				
R Square	0.727				
Adjusted R Square	0.726				
Standard Error	1.27966				
Observations	591				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	2560.283	853.428	521.171	0.000
Residual	587	961.224	1.638		
Total	590	3521.507			
	Unstandardised Coefficients B	*Standard Error*	*Standardise Coefficients* Beta	*t Stat*	*P-value*
Intercept	0.392	0.260		1.504	0.133
Perceived Benefits	0.922	0.026	0.814	35.445	0.000
Perceived Barriers	-0.078	0.033	-0.059	-4.904	0.000
Institutional Quality	0.106	0.031	0.109	3.444	0.001
Dependent variable: IRV (with accessibility statement)					

Table 8.
Multiple Linear Regression Results for IRV (with the accessibility statement)

However, when the respondents were informed that there were more than 90 percent of the respondents in a recent survey who have the intention to take the vaccine, institutional quality turned out to be a significant variable in explaining the vaccination behaviour. This shows that the accessibility of information is crucial in influencing behaviour. Hence, given the importance of herd immunity and institutional quality, the effectiveness of a vaccine strategy that helps to boost non-pharmaceutical interventions, such as testing and magnifying vaccine impact, are also hugely dependent on the communication channels, content, and the ways health messages are sent to the public. Be it a vaccination program, face mask-wearing (e.g. Suzuki *et al.*, 2021), or other interventions, world leaders must take immediate actions to manage the pandemic (Ajmal *et al.*, 2021). Signorelli *et al.* (2020) also highlighted that public health authorities should continue monitoring herd immunity's effects as one of the approaches to control the COVID-19 outbreak.

In the meantime, institutional quality plays an important role in promoting the quality of the healthcare system (see also Gille and Brall, 2020). Public health practices and strategies will not be effective and efficient without collaboration between public and private sectors, as well as individuals. Ferrari and Salustri (2020) conducted research using a European panel data set and showed that corruption impacts public healthcare services, especially females and those in society with lower socioeconomic status.

There are certain limitations of this study. It was conducted before the efficacy of the various COVID-19 vaccines was known to the public. The survey results may be different if the respondents had known this information. Another limitation of the study is that the scope of the perspectives used is limited to HBM, behavioural economics, and institutional quality. Future research can incorporate other perspectives which are relevant as predictors of IRV, for example, religions, philosophy, history, politics, etc.

Moreover, given the non-probability sampling method, the result of this study may not be generalisable to other research settings. With the urgency of examining IRV in time with

different types of vaccines developed and getting approval from the World Health Organization (WHO), we faced time constraints in implementing a random sampling method. Moreover, with the uncertainties that arise with the efficacy of the vaccines, there are challenges such as low response rates and insufficient responses from different countries. Future studies shall use a random sampling method to replicate such research in understanding vaccination behaviour or choice behaviour in health-related studies. Besides, studies in the future shall use structural equation modelling (SEM) to examine the relationship of the predictors with vaccination behaviour.

Conclusion

This study is one of those few cross-country studies investigating the predictors of IRV as well as the first to investigate how one of these predictors, i.e. the institutional quality and herding, influence IRV. Based upon multiple regression analyses, this study found five significant predictors of IRV: Perceived Benefits, Perceived Barriers, Perceived Susceptibility, Herding, and Institutional Quality. The results reveal that the respondents behaved differently before and after they were provided information incorporating the impact of herding. Before they were provided with the information, Perceived Benefits, Perceived Barriers, Herding, and Perceived Susceptibility were the predictors of IRV. After they were provided such information, Perceived Benefits, Perceived Barriers, and Institutional Quality became the significant predictors.

This research shows that once people possess the herding mentality after being exposed to information encouraging such behaviour, their focus shifts to institutional quality as one factor influencing their IRV. This reflects that the effectiveness of government authorities, regulatory quality, the rule of law, and control of corruption are also significant predictors of IRV but only within a herding mentality.

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