Living in a Region With a Low Level of COVID-19 Infection: Health Belief Toward COVID-19 Vaccination and Intention to Receive a COVID-19 Vaccine in Hong Kong Individuals

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Abstract
Introduction: Vaccination is vital for controlling the COVID-19 pandemic. Individuals’ vaccination intention is a good predictor of vaccine uptake and is influenced by individuals’ health belief toward vaccination. Regions with different levels of pandemic severity may present varying effects. This study aimed to determine the influence of health belief on COVID-19 vaccination intention in a region with a low level of COVID-19 infection.

Methods: This cross-sectional telephone survey was conducted on a quota sample of 800 adults in Hong Kong before the commencement of the local COVID-19 vaccination program. The Health Belief Model Scale—COVID-19 was developed to assess health belief toward COVID-19 vaccination. The contribution of health belief on explaining intention to receive the COVID-19 vaccine was assessed using logistic regression.

Results: The subjects demonstrated moderate levels in all aspects of health belief. Only 28.9% of the subjects indicated an intention to receive a COVID-19 vaccine. After controlling for age, educational level, marital status, and high risk status, the logistic regression analysis indicated that perceived benefits of vaccination (OR = 1.615; CI 95%: 1.443–1.807; P < .001), perceived susceptibility to COVID-19 (OR = 1.130; CI 95%: 1.032–1.237; P = .008), cues to action toward vaccination (OR = 1.212; CI 95%: 1.108–1.326; P < .001), and perceived barriers to vaccination (OR = .696; CI 95%: .641–.756; P < .001) were associated with intention to receive a COVID-19 vaccine.

Conclusion: Vaccination campaigns in regions with good control of the pandemic should promote the benefits of vaccination, emphasizing how it can help individuals regain a sense of normalcy in their daily lives and stop the spread of COVID-19. Although the COVID-19 pandemic affects countries worldwide, this study highlights the importance of adopting specific vaccination promotion strategies for regions with different levels of pandemic severity.

Keywords
COVID-19, health belief model, health belief, vaccine, intention, Hong Kong

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What do we already know about this topic?
Previous studies tentatively indicate that individuals living in a region with a low level of COVID-19 infection report low intention to receive a COVID-19 vaccine.

How does your research contribute to the field?
This survey, which was conducted in Hong Kong on a stratified sample of 800 individuals representing the age and gender distribution of the adult population, contributes to our understanding of the influence of health belief on COVID-19 vaccination intention in a region with a low level of COVID-19 infection.

What are your research’s implication toward, practice, or policy?
Vaccination campaigns in countries/regions with low levels of COVID-19 infection should place major emphasis on the benefits of vaccination and how the vaccine can help individuals regain a greater sense of normalcy in their daily lives and stop the spread of COVID-19.

Introduction
The coronavirus disease (COVID-19) struck Wuhan City, China in late 2019. It rapidly spread to the neighboring Asian countries and then to countries worldwide. The World Health Organization (WHO) classified it as a controllable pandemic on 12 March 2020. Although certain measures, such as maintaining personal hygiene, social distancing, stringent testing, lockdowns, and border control, have been carried out in many countries for more than a year, the pandemic shows no indications of subsiding. Furthermore, the pandemic has resurfaced in many countries. The ongoing COVID-19 pandemic has resulted in a tremendous health and economic impact to countries worldwide. This impact intensifies the need for an effective vaccine to contain the pandemic. Research teams across the world are racing against time and using different technologies to develop a vaccine for COVID-19. Clinical trials have been conducted, and the results were encouraging. By the end of 2020, vaccines were available for emergency use. Nevertheless, there have been numerous concerns and mistrust of the newly developed vaccines in the general public around the world. In the global context, specific local factors may pose additional influence on individuals’ intention to vaccinate against COVID-19. In the national or regional context, specific local factors may pose additional influence on individuals’ intention to receive vaccine. Hong Kong, a region with a low level of COVID-19 infection, has consistently reported low intention to receive vaccine with a rate ranging between 4.2% and 42.0%. Such phenomenon deserves scientific investigation.

Herd Immunity, Vaccination Hesitancy, and Intention to Receive a COVID-19 Vaccine
From a public health perspective, a vaccine for containing an infectious disease can only be effective when a substantial proportion of a population has received it. Individuals who have not been vaccinated can be indirectly protected when most of the population is immune to an infectious disease through vaccination. This type of indirect protection is known as herd immunity. The WHO states that the COVID-19 vaccination coverage required to achieve herd immunity is unknown, but researchers are encouraged to conduct further investigation. A simulation experiment indicated that a vaccination coverage rate of 75% is necessary to largely eradicate the COVID-19 pandemic as long as the vaccine efficacy reaches 80%.

Although the vaccination coverage rate is essential, vaccination hesitancy among the general public may compromise the overall effectiveness of the vaccine in containing the pandemic. Vaccination hesitancy was significant during the last H1N1 worldwide pandemic, and most countries reported a vaccination rate below 50%. Certain factors, such as believing that one has a low risk of acquiring H1N1, being concerned about the vaccine’s safety, and believing that the vaccine had not been properly tested, were related to vaccine non-uptake. In particular, vaccination hesitancy for the COVID-19 vaccine can be caused by a number of factors. The development time of the COVID-19 vaccine is considerably short. In standard practice, a vaccine for an infectious disease should be produced in several years. The production time of the COVID-19 vaccines has been significantly shortened due to the urgent and great necessity. Consequently, there have been numerous concerns on the effectiveness, safety, and side effects of the newly developed vaccines. The latter concern draws much attention, especially when severe adverse side effects, such as anaphylaxis and Bells’ palsy, are reported. The WHO admits that research on the strength and length of the vaccines is still underway. Experts are uncertain about the duration of immunity protection and long-term side effects.

Intention is a good predictor of vaccine uptake before the availability of the vaccines. The intention to receive a COVID-19 vaccine varies among countries/regions. Low intention rates have been reported in Hong Kong (4.2%–42.0%). Moderate intention rates have been reported in the US (39.4%–49.1%), Malaysia (48.2%), and the UK (63.5%–64.0%). High intention rates have been reported
in the UK (85.6%). However, direct comparison of the findings between the studies from different countries/regions is difficult because of the nature of the COVID-19 pandemic over the last year fluctuated from time to time and varied among countries. With reference to the time when the study was conducted, Hong Kong, which has a population of 7.5 million people, reported an accumulation of 4984 confirmed cases and 102 deaths in mid-September 2020. Malaysia, which has a population of 32.7 million people, reported an accumulation of 7417 confirmed cases and 115 deaths at the end of May 2020. The UK, which has a population of 67.1 million people, reported an accumulation of 467 146 confirmed cases and 42 268 deaths in early October 2020. Moreover, the UK experienced a period of lockdown in early April 2020 when the pandemic situation was greatly severe. The difference in the reported intention rates tentatively suggests that individuals in countries/regions where the pandemic is better controlled report low intention to receive the vaccine, and vice versa. Individuals’ need for the vaccine is not intense when they perceive that the pandemic is not a threat. By contrast, individuals report a higher intention rate when they believe that the threat of COVID-19 has become severe. In the event of a lockdown, individuals are keen to seek more protection for their health. Thus, the demand for vaccine is particularly high. Interpretation of the previous findings should also consider that some studies allow the subjects to answer questions according to their own interpretation of the situation. Another study assessed their subjects’ intention under specific hypothesized scenarios combining effectiveness, safety, and cost of the vaccine. Thus, findings vary between studies.

**Health Belief Toward COVID-19 Vaccination**

Receiving the COVID-19 vaccine is a health behavior to avoid contracting COVID-19. A model of health behavior can be used to support research on uptake of a health behavior. A number of models, such as the Health Belief Model, Theory of Planned Behavior, and Diffusion of Innovation Theory, have been used to explain health behavior. The Health Belief Model was specifically developed for preventive health research. This model has been empirically tested and is one of the most widely used models in understanding preventive health behavior and resulting actions. In particular, this model has been repeatedly used in vaccination studies to determine the likelihood of vaccination. Thus, this study considered the Health Belief Model as the preferred model for investigating health belief and intention regarding COVID-19 vaccination.

The Health Belief Model predicts and explains health behavior by considering a number of constructs, including an individual’s perceived susceptibility to the targeted disease, perceived severity of the targeted disease, perceived benefits of and perceived barriers to adopt the health behavior, self-efficacy to engage in the health behavior, and presence of cues to action to guide an individual to engage in the health behavior. Constructs of the Health Belief Model are recognized as important predictors and have been used to predict and explain the uptake of the influenza vaccination and COVID-19 vaccination. Previous studies indicated that perceived susceptibility of becoming infected with COVID-19, perceived benefits of vaccination, perceived severity of COVID-19, and cues to action toward vaccination are positively associated with vaccination intention. By contrast, perceived barriers to vaccination are negatively associated with vaccination intention. However, these studies have major limitations, such as recruiting a non-population-based sample, which is less able to represent the target population, and using an online survey, which is unlikely to recruit computer illiterate subjects. The latter practice was common during the pandemic because of restrictions in social contact and gathering. The representativeness of their samples was queried; thus, previous findings should be interpreted with caution. Individuals in countries/regions where the levels of pandemic are different present varying levels of intention to receive vaccine. They may also present a different health belief toward vaccination. This situation is a potential research gap that deserves investigation.

This study investigated the role of health belief in explaining intention to receive a COVID-19 vaccine by addressing the limitations of previous studies and research gap. The objectives were as follows: (1) to examine the health belief toward COVID-19 vaccination; (2) to examine the intention to receive a COVID-19 vaccine; and (3) to estimate the contribution of health belief toward COVID-19 vaccination on explaining intention to receive a COVID-19 vaccine. Using the Health Belief Model to explain people’s intention to receive a COVID-19 vaccine is considered suitable and enhances comparison between studies. The findings of the study targeting the various constructs of the Health Belief Model can be essential in guiding the planning and implementation of the COVID-19 vaccination program, increasing the acceptance of vaccines, and limiting the spread of the disease. In particular, the findings can be useful to countries that report unsatisfactory vaccination rates. Moreover, the findings will be used to promote vaccination in the future in case of other pandemics. Regions with different levels of pandemic severity present a different phenomenon. As a Hong Kong–based study, this work will help us better grasp the situation, which is unique to a region with a low level of COVID-19 infection.

**Methods**

**Design**

This work was a cross-sectional descriptive telephone survey. A descriptive approach was adopted to describe the health belief and intention of subjects. A telephone survey was...
considered appropriate during the COVID-19 pandemic when social interaction was not encouraged. This method has been successfully used in studies during the COVID-19 pandemic.2,29

Setting
This study was conducted in Hong Kong. Hong Kong is one of the most effective regions in the world in containing the COVID-19 pandemic.30 This region has fewer confirmed cases and a flatter pandemic curve than other countries.31 This satisfactory outcome is mainly attributed to 2 practices. First, Hong Kong adopts the “zero infections” approach to contain COVID-19, while some other countries adopt the “living with the virus” approach. Accordingly, stringent public health measures are implemented. Certain measures, such as social distancing, rigorous contact tracing and testing, lockdown of residential buildings or locations for mass testing, border restrictions, and mandatory quarantine for inbound travelers, have been in place.2,29 Second, adoption of health preventive behaviors among individuals is almost universal. The use of face masks in the population is over 98.8%,32 and the practice of good hand hygiene exceeds 95%.31 Overall, life in Hong Kong remains quite normal despite some restrictions in social gatherings and cross-border travel. These restrictions are adjusted from time to time depending on the severity of the local pandemic,2 but individuals have become used to such adjustments.

Hong Kong commenced its territory-wide COVID-19 vaccination program with the Sinovac and BioNTech vaccines on 26 February 2021, with the aim of providing vaccines for approximately 7.5 million Hong Kong residents within 2021. High risk groups, such as people aged 60 years old and above, people with chronic diseases, residents of residential care homes, healthcare workers, and workers employed in residential care settings, have been prioritized. A Hong Kong resident can receive a vaccine via the public health sector free of charge.33

This study was conducted during 1–14 February 2021. It began immediately before the commencement of the COVID-19 vaccination program. During that time, Hong Kong was experiencing the fourth wave of the COVID-19 outbreak, which lasted from late November 2020 to late April 2021. As of 1 February 2021, Hong Kong reported 10 486 confirmed cases and 182 deaths.34

Sampling
This study adopted quota sampling to recruit 800 Hong Kong adults. The sample was stratified into 14 strata (Table 1) based on the age and gender distribution of the adult proportion in Hong Kong.35 The researchers recruited subjects through their network and filled up each stratum according to the predetermined size. Quota sampling increases the representativeness of the sample but does not require a sampling frame and strict application of random sampling.36 According to the Cochran formula, a sample size of 800 was adequate to attain a margin of error of 5% and a confidence level of 99% for a population of 6 165 223 Hong Kong adults aged 20 years old and above.

Adults who were aged 20 years old and above, able to communicate in Cantonese (a common dialect in Hong Kong), and lived in Hong Kong during the COVID-19 pandemic were included. Adults who were not advised to

### Table 1. Distribution of age and gender in the adult population and study sample.

| Age    | Gender | Hong Kong population (n = 6 165 223) | Sample (n = 800) |
|--------|--------|-------------------------------------|------------------|
|        |        | Frequency | Percentage (%) | Frequency | Percentage (%) |
| 20–29  | Male   | 448 018   | 7.3           | 58    | 7.3           |
|        | Female | 507 292   | 8.2           | 66    | 8.2           |
| 30–39  | Male   | 460 970   | 7.5           | 60    | 7.5           |
|        | Female | 687 555   | 11.2          | 90    | 11.2          |
| 40–49  | Male   | 474 874   | 7.7           | 62    | 7.8           |
|        | Female | 661 968   | 10.7          | 86    | 10.7          |
| 50–59  | Male   | 599 552   | 9.7           | 78    | 9.8           |
|        | Female | 666 562   | 10.8          | 86    | 10.7          |
| 60–69  | Male   | 440 629   | 7.1           | 57    | 7.1           |
|        | Female | 450 353   | 7.3           | 58    | 7.3           |
| 70–79  | Male   | 213 407   | 3.5           | 28    | 3.5           |
|        | Female | 213 794   | 3.5           | 28    | 3.5           |
| 80+    | Male   | 133 116   | 2.2           | 18    | 2.3           |
|        | Female | 207 133   | 3.3           | 25    | 3.1           |
| Total  | Male   | 2 770 566 | 44.9          | 361   | 45.1          |
|        | Female | 3 394 657 | 55.1          | 439   | 54.9          |
| Both genders | 6 165 223 | 100.0        | 800 | 100.0            |
receive a COVID-19 vaccine (e.g., adults with severe allergic reaction, adults with severe chronic illness, and adults who were very frail or bedridden) were excluded. Adults who had received a vaccine, most probably in another country, were excluded because this study aimed to examine adults’ intention to receive a COVID-19 vaccine before the vaccination program. Adults infected with COVID-19 were excluded because they were receiving treatment, and the outcome was unknown.

Data Collection

A three-part questionnaire was used to collect data. Part A comprises questions on personal characteristics. Part B comprises questions on health belief toward COVID-19 vaccination. Questions were adopted from the Health Belief Model Scale and translated from English to Chinese. Given that the Chinese version of the Health Belief Model Scale was developed to assess health belief toward influenza vaccination, some questions were modified by the researcher to assess health belief toward COVID-19 vaccination. The scale was renamed the Health Belief Model Scale–COVID-19. Thirty-one questions divided into 5 sub-scales covered the various constructs of the Health Belief Model, including (1) perceived susceptibility to COVID-19 (5 questions); (2) perceived severity of COVID-19 (5 questions); (3) perceived benefits of COVID-19 vaccination (5 questions); (4) perceived barriers to COVID-19 vaccination (8 questions); and (5) cues to action toward COVID-19 vaccination (8 questions). Each question was rated on a four-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). The score for each sub-scale was calculated by summing the score for all the questions within a sub-scale. Among the various constructs of the Health Belief Model, this study did not measure self-efficacy because this construct was unnecessary to understand a simple health behavior. This study validated the Health Belief Model Scale–COVID-19 before using it to collect data. The Health Belief Model Scale–COVID-19 demonstrated satisfactory content validity and internal consistency. It has a content validity index of .88, according to an expert panel of 3 academics and 3 clinical nurses with a background on infectious disease. The Cronbach’s alpha values for the sub-scales were .793 (perceived susceptibility to COVID-19), .746 (perceived severity of COVID-19), .698 (perceived benefits of COVID-19 vaccination), .802 (perceived barriers to COVID-19 vaccination), and .751 (cues to action toward COVID-19 vaccination). Part C provides a single question on intention to receive a COVID-19 vaccine on a dichotomous scale (yes/no). The questionnaire was administered through telephone interview. The questions were read by an experienced researcher.

The entire questionnaire set was pilot tested on 50 individuals. Individuals’ responses indicated that the questions were clear and relevant to their situations. There were no missing or double responses. The administration process was smooth. No revisions were made to the questionnaire.

Before the data collection, the researchers briefed the subjects and sought their consent. The subjects were informed about the purpose and nature of the study, their expected involvement, and rights to participate and quit. Moreover, they were informed of voluntary participation, anonymity in data collection, and confidentiality in data handling. All subjects gave verbal informed consent prior to participation. All research methods were conducted in accordance with the Declaration of Helsinki. This study obtained ethics approval by the Research Ethics Committee of The Open University of Hong Kong (the former title of Hong Kong Metropolitan University) (Ref: HE-SF2021/03).

Statistical Analyses

Statistical analyses were conducted using Statistical Package for the Social Sciences (version 26). Descriptive statistics (frequency and percentage for categorical variables and means and standard deviations for continuous variables) were computed to summarize subjects’ sociodemographic and health characteristics, health belief toward COVID-19 vaccination, and their intention to receive a COVID-19 vaccine. The chi-square test was used to compare the difference in proportion of the various sociodemographic and health characteristics between subjects who intended and did not intend to receive the COVID-19 vaccine. An independent t-test was used to compare the difference in health belief between subjects who had different intentions to receive the COVID-19 vaccine. Significant factors in the above univariate analyses were considered for multivariate analysis. The significant health belief variables were entered into a logistic regression model to explain the intention to receive a COVID-19 vaccine by arranging the significant sociodemographic and health variables as covariates. A P-value of below .05 indicated statistical significance.

Results

We approached a total of 848 individuals. Eight hundred subjects were recruited to participate in the study. The response rate was 94.3%. All the questionnaires were valid, with no missing data. The subjects represented the age and gender distribution of the Hong Kong adult population. Over half of the subjects were female (54.9%), married (62.9%), lived with family members (86.5%), had not received influenza vaccination in the last year (74.3%), and belonged to the non-high risk group for COVID-19 (62.4%). Nearly half of the subjects attained tertiary education and above (45.5%). A total of 231 subjects (28.9%) intended to receive a COVID-19 vaccine. A significant difference was observed in their distribution proportion in age group, educational level, marital status, and high risk group between subjects who intended and did not intend to receive a COVID-19 vaccine. Subjects who intended to receive a COVID-19 vaccine were older ($\chi^2 = 55.239, P < .001$), had lower educational level ($\chi^2$
Table 2. Sociodemographic and health characteristics (n = 800).

| Sociodemographic and health characteristic | All subjects (n = 800) | Subjects intend to receive a COVID-19 vaccine | χ² | p |
|-------------------------------------------|-----------------------|---------------------------------------------|----|---|
| Age                                       | 55.239                | <.001***                                    |    |   |
| 20–29                                     | 125 (15.6)            | 19 (8.2)                                   | 106 (18.6) |
| 30–39                                     | 150 (18.58)           | 24 (10.4)                                  | 126 (22.1) |
| 40–49                                     | 148 (18.5)            | 38 (16.35)                                 | 110 (19.3) |
| 50–59                                     | 162 (20.3)            | 59 (25.5)                                  | 103 (18.1) |
| 60–69                                     | 115 (14.4)            | 44 (19.0)                                  | 71 (12.5)  |
| 70–79                                     | 56 (7.0)              | 21 (9.1)                                   | 35 (6.5)   |
| 80+                                       | 44 (5.5)              | 26 (11.3)                                  | 18 (3.2)   |
| Gender                                    |                       | .007 .931                                   |    |   |
| Male                                      | 360 (45.0)            | 105 (45.5)                                 | 255 (44.8) |
| Female                                    | 440 (55.0)            | 126 (54.5)                                 | 314 (55.2) |
| Educational level                         | 56.030                | <.001***                                    |    |   |
| Below primary                             | 31 (3.9)              | 11 (4.4)                                   | 20 (3.5)   |
| Primary                                   | 119 (14.9)            | 60 (26.0)                                  | 59 (10.4)  |
| Secondary                                 | 287 (35.9)            | 98 (42.4)                                  | 189 (33.2) |
| Tertiary and above                        | 363 (45.4)            | 62 (26.8)                                  | 301 (52.9) |
| Marital status                            | 12.307                | <.01***                                    |    |   |
| Single                                    | 250 (31.3)            | 61 (26.4)                                  | 189 (33.2) |
| Married                                   | 503 (62.9)            | 151 (65.4)                                 | 352 (61.9) |
| Divorced                                  | 27 (3.4)              | 7 (3.0)                                    | 20 (3.5)   |
| Widowed                                   | 20 (2.5)              | 12 (5.2)                                   | 8 (1.4)    |
| Living status                             | 2.244                 | .326                                        |    |   |
| Live alone                                | 55 (6.9)              | 19 (8.2)                                   | 36 (6.3)   |
| Live with family members                  | 719 (86.5)            | 201 (87)                                   | 515 (90.5) |
| Live with others                          | 29 (3.6)              | 11 (4.7)                                   | 18 (3.2)   |
| History of influenza vaccination           | .202                  | .653                                        |    |   |
| No                                        | 594 (74.3)            | 169 (73.2)                                 | 425 (74.7) |
| Yes                                       | 206 (25.8)            | 62 (26.8)                                  | 144 (25.3) |
| High risk group*                          | 35.670                | <.001***                                    |    |   |
| No                                        | 499 (62.4)            | 107 (46.3)                                 | 392 (68.9) |
| Yes                                       | 301 (37.6)            | 124 (53.7)                                 | 177 (31.1) |

*High risk group: adults >60 years old, adults with chronic disease, residents of elderly residential care home or residential care home for persons with disabilities, healthcare workers, or staff of residential care homes.

**P = .01, ***P = .001.

= 56.030, P < .001), married (χ² = 12.307, P < .01), and belonged to the high risk group (χ² = 35.670, P < .001) than their counterparts (Table 2).

Subjects demonstrated a moderate level of health belief toward COVID-19 vaccination in all aspects. A significant difference was observed in all aspects of health belief between subjects who intended and did not intend to receive a COVID-19 vaccine. Subjects who intended to receive a COVID-19 vaccine reported higher perceived susceptibility to COVID-19 (t = −9.278, P < .001), higher perceived severity of COVID-19 (t = −2.815, P < .01), higher perceived benefits from a vaccine (t = −15.837, P < .001), lower perceived barriers to receive a vaccine (t = 14.013, P < .001), and more cues to action for the vaccination (t = −11.757, P < .001; Table 3).

The 5 aspects of health belief were considered for logistic regression analysis by adjusting the influence of the significant sociodemographic and health variables (age, educational level, marital status, and high risk status). The model explained 60.7% (Nagelkerke R²) of the variance in intention to receive a COVID-19 vaccine and correctly classified 87.0% of cases. Their odds ratios (ORs) and 95% confidence intervals (CIs) were derived. Four aspects of health belief, namely, perceived benefit (OR = 1.615; CI 95%: 1.443–1.807; P < .001), cues to action (OR = 1.212; CI 95%: 1.108–1.326; P < .001), perceived susceptibility (OR = 1.130; CI
95%: 1.032–1.237; P = .008), and perceived barrier (OR = .696; CI 95%: .641–.756; P < .001), were associated with intention to receive a COVID-19 vaccine. The likelihood to receive a COVID-19 vaccine was higher with a higher level of perceived benefit, cues to action, and perceived susceptibility. A lower likelihood to receive a COVID-19 vaccine was observed when the perceived barrier was higher (Table 4).

### Discussion

This study found that the intention to receive a COVID-19 vaccine in Hong Kong individuals was low (28.9%). Greater perceived benefits of a vaccine, greater cues to action toward COVID-19 vaccination, greater perceived susceptibility to COVID-19, and lesser perceived barriers to COVID-19 vaccination explained 60.7% of the variance in vaccination intention. In particular, the perceived benefits of the vaccine explained the highest vaccination intention, while the perceived barriers to COVID-19 vaccination explained the least. The findings differed from those in other studies. This study was conducted in Hong Kong and contributed to our understanding of the situation in Hong Kong and countries/regions that have been relatively successful in containing the COVID-19 pandemic. This knowledge is of paramount importance because it can provide specific insights that can aid health authorities of those countries in increasing individuals’ intention to receive the vaccine and containing the pandemic.

### Intention to Receive a COVID-19 Vaccine

Only 28.9% of the subjects have an intention to receive a COVID-19 vaccine. This study supported the earlier interpretation that individuals in countries/regions where the pandemic is well controlled report low intention to receive a vaccine with reference to a wide range of intention rates (4.2%–85.6%) reported by previous studies.2,3,9,17-19

Hong Kong studies consistently report low vaccination intention rates. A local study conducted during 16–30 September 2020 reported an intention rate from 4.2% (under the least ideal scenario: cost HK$500, 50% effectiveness, and mild side effects commonly occur) to 24.0% (under the intermediate scenario: free of charge, 80% effectiveness, and mild side effects commonly occur) and further to 38.0% (under the most ideal scenario: free of charge, 80% effectiveness, and mild side effects rarely occur).2 Another local study conducted between December 2020 and January 2021 reported an intention rate of 42.0%.11 This study conducted during 1–14 February 2021 indicated that the intention rate was 28.9%. All the reported rates were far lower than the requirement to achieve herd immunity.13 Despite the
numerous vaccination promotion activities that occurred during the past months, the vaccination intention rate remained low. The situation in Hong Kong is unique. Hong Kong has a very low level of COVID-19 infection because of the implementation of all the stringent public health measures. Moreover, the situation at present is improving compared with that in the past. A more severe pandemic wave (the third wave) occurred in July last year with 149 new cases on 28 July 2020. One year later, Hong Kong experienced a long period of 7 months from 8 June 2021 to 13 January 2022 without a community outbreak. During this period, most of Hong Kong’s new cases were found in inbound travelers who were identified through the local quarantine rules.34 Hong Kong individuals might think that the existing measures are effective to protect them from COVID-19 and rely less on the vaccine.2 This argument is supported by the finding that individuals perceived that they have a moderate level of perceived susceptibility to COVID-19 only. The low vaccination intention rate deserves attention because individuals’ actual vaccine update is likely to be lower than their intention.2 Moreover, extensive vaccination in the Hong Kong population is essential to contain the global pandemic.

**Health Belief and Intention to Receive a COVID-19 Vaccine**

Findings indicated that individuals with a higher level of perceived benefits, cues to action, and perceived susceptibility would have a higher likelihood to receive a vaccine. By contrast, individuals with a higher level of perceived barriers would have a lower likelihood to receive a vaccine. These factors could explain as much as 60.7% of the variance in intention to receive a COVID-19 vaccine. Effective public health promotion measures should address these aspects.

Among the 4 types of health belief that contributed to intention to receive a COVID-19 vaccine, perceived benefits reported the strongest OR, and perceived barriers reported the weakest OR. Specifically, perceived benefits affect intention to receive a COVID-19 vaccine most, and perceived barriers affect intention least. By contrast, previous studies in other countries identified the unknown safety and side effect of vaccines, which are factors categorized under perceived barriers to vaccination, as the most important determinants of unwillingness to receive a vaccine or the most frequently cited concerns.2,17-19 In addition, this study found that individuals’ perceived severity of the disease was not associated with intention to receive a vaccine. This result is in accordance with the earlier non-significant findings reported in Hong Kong but is in contrast with the results reported elsewhere.3,9 The unique situation in Hong Kong is highlighted.

Hong Kong exercises good control of the pandemic, with few incidences of confirmed cases. This study was conducted at the end of the fourth wave of the local COVID-19 outbreak, during which the pandemic situation continued to settle. The daily number of new cases dropped from 115 (on 27 November 2020; peak of the fourth wave) to 19 (on 1 February 2021) and then to 8 (on 14 February 2021).34 In view of the situation, the Hong Kong Government eased its social distancing measures on 18 February 2021. For example, gyms, theme parks, and cinemas were reopened. Dine-in services at restaurants were extended by 4 hours to 10 PM. Life in Hong Kong was mostly normal, except for regulations on the mandatory use of face masks and a few restrictions in social gatherings and travel. When the impact of COVID-19 on individual health is not a major concern, individuals rely less on the vaccine. Individuals likely pay less attention to the side effects of the vaccines but focus on their benefits. The difference in findings between studies can also be related to the time that they were conducted. Previous studies were mostly conducted in 2020 when vaccines were unavailable, and their side effects and safety were yet unknown.2,17-19 Individuals in previous studies perceived that the vaccines were rushed into development and had not been properly tested.3 However, this study was conducted in February 2021 when the vaccines and their related information became available. Our subjects showed lesser uncertainty about the side effects of vaccines because details about COVID-19 vaccination were apparent. Thus, a weaker relationship between perceived barriers and intention to receive a vaccine was reported.

Public health promotion strategies for COVID-19 vaccination should match with the context of the population. In populations with great concerns and mistrust of the vaccines, health promotion strategies should focus on delivering factual information of vaccines, addressing their misinformation, and building confidence toward the vaccines.2,18,19 In populations less concerned about the effect and safety of the vaccines, such as the Hong Kong population, health promotion strategies should focus on the personal and community benefits of vaccination. Most Hong Kong individuals are hoping for an end to the COVID-19 pandemic and a return to normalcy. One of the most frequently discussed vaccination benefits is whether a COVID-19 vaccination record makes cross-border travel easier.2 Currently, Hong Kong is imposing stringent restrictions on cross-border travel to prevent imported cases from entering the community. Controlling the pandemic is of utmost priority.59 The Hong Kong government states that if individuals want to have cross-border travel relaxed to a wider scale, then the vaccination rate has to be high.40 Although individuals are looking for benefits before considering vaccination, the government is urging individuals to be vaccinated to gain such benefits. A disparity of intention between the 2 parties exists. As long as COVID-19 exists, the current pandemic situation has not yet reached the point where we can instantly turn everything to normal. A more realistic approach to promote COVID-19 vaccines is to
associate them with a larger extent of normalcy or a “new normal” in daily life during the pandemic.

**Intention to Receive a COVID-19 Vaccine in Specific Groups**

Specific groups, including young adults (age 20–49 years old), singles, with tertiary education or higher, and did not belong to the high risk group for COVID-19, were found to have a relatively low intention to receive a vaccine. To a certain extent, this result is consistent with some prior works showing that young adults report low intention to receive a COVID-19 vaccine or a high level of vaccination hesitancy.\(^2\)\(^,\)\(^18\) The abovementioned specific groups possibly perceived themselves to have a lesser risk of getting COVID-19, so they were less motivated to be vaccinated. However, their involvement in the vaccination program is essential to achieve herd immunity of the whole community. Additional efforts are required to boost the intention to vaccinate in these specific groups. Tailoring age-friendly and population-specific logistics are essential. Using an evidence-based approach in advertising to young adults who have attained tertiary education might be more relevant and effective than the currently employed techniques.\(^2\) Utilizing an online platform to disseminate factual information and correct misconceptions of vaccines can address the information needs of young adults in a timely and flexible manner. Arranging celebrities and social media influencers, who have the trust of the younger adults, to advocate vaccination can improve vaccine uptake. Lastly, offering online appointment booking can facilitate the young adults to conveniently schedule their appointments and receive the vaccines.

**Strengths and Limitations**

The study recruited a stratified sample, which represented the age and gender distribution of the Hong Kong adult population, thereby increasing the representativeness of the sample. In this study, the young adults were found to report low vaccination intention. Age-stratified research may be necessary in the future to understand how health belief varies among age groups and interacts with intention to become vaccinated.

This study had 4 limitations. First, this cross-sectional study could not infer causality. It was unable to establish a cause-and-effect relationship between the various constructs of the Health Belief Model and vaccination intention. Second, this study considered intention as an indicator of vaccine uptake. This initiative was carried out because vaccine update could not be measured before the vaccination program. However, intention may not always be translated into actual behavior. Individuals may encounter practical barriers that render them unable to be vaccinated. Future studies are suggested to examine the discrepancy between individuals’ intention and their actual behavior on vaccine uptake. Third, this study focused on the period immediately before the vaccination program. Although this study presented the situation at a particular stage of the pandemic, it was unable to reveal the situation shortly afterwards. The virus may evolve into variants as the pandemic progresses, and it may develop into a mild or severe one. Moreover, additional concrete information about the vaccine and the vaccination arrangement will be available. Individuals may change their health belief and vaccination intention accordingly. In the future, follow-up or longitudinal studies should be conducted to compare the changes in health belief and intention to receive a vaccine before and during the different time points of the vaccination program. Fourth, subjects were recruited through the researchers’ network because a list of telephone numbers of the Hong Kong residents was unavailable. Future research is suggested to explore the option of obtaining a list of telephone numbers of Hong Kong residents or residential telephone directory to ensure that subjects can be randomly recruited.

**Conclusions**

Vaccination is crucial for controlling the COVID-19 pandemic. However, its success depends on the extensive uptake of the vaccine in populations worldwide. This study examined the health belief toward COVID-19 vaccination, intention to receive a COVID-19 vaccine, and the contribution of health belief toward COVID-19 vaccination on explaining intention to receive the COVID-19 vaccine in individuals who were living in a region with a low level of COVID-19 infection. The findings indicated that individuals have low intention (28.9%) to receive the vaccine. Moreover, this work identified the perceived benefits of vaccination as the most important health belief that explained vaccination intention in countries/regions with low levels of COVID-19 infection. Vaccination campaigns in these countries/regions should place major emphasis on the benefit of vaccination and how the vaccine can help individuals regaining a larger sense of normalcy in their daily lives and stop the spread of COVID-19. Although the COVID-19 pandemic affects countries worldwide, this study highlights the need of adopting specific vaccination promotion strategies for countries/regions that are facing different levels of pandemic severity.

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**Authors’ contributions**

All authors had made substantial contributions to the conception and design of the research. KYC, MHWC, CTCW, HPYL, ICWC, CKYN, RYSW, ALCP, YHYN, and JKCN collected the data and conducted statistical analyses. All authors interpreted the data. LYKL drafted the manuscript. KYC, MHWC, CTCW, HPYL,
ICWC, CKYN, RYSW, ALCP, YHYN, and JKCN critically revised the manuscript. All authors read and approved the submitted version of the manuscript and the final version to be published. Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the content.

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