What determines Hong Kong South Asians' perceptions on COVID-19 vaccine? Implications on culturally appropriate vaccine messages for ethnic minority community

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Abstract
Guided by the behavioral model of health service use, this study examined the effect of South Asians' perceptions of healthcare, religious belief, and socioeconomic status on their perceived benefits and risks of COVID-19 vaccines (N = 245). Cross-sectional survey was used. Logistic regressions results showed that higher levels of perceived involvement in South Asian community health and trust in the healthcare system were associated with higher odds of reporting perceived vaccine benefits. Permanent residents, students (vs. unemployed), and Pakistani (vs. Indians) also perceived the vaccine as beneficial. On the other hand, believing that the body was sacred and being Buddhist (vs. Hindu) were associated with higher odds of perceiving severe vaccination risk. Those who believed that God would cure COVID-19 and those with higher education tended to perceive the vaccine as having a limited effect. Implications on designing culturally appropriate COVID-19 vaccines messages in interethnic settings are discussed.

Keywords
community, COVID-19, cultural, ethnic minority, perceptions, South Asians, vaccine
1 | INTRODUCTION

With the resurgence of the COVID-19 pandemic even in jurisdictions which had been able to control the initial outbreak, there is a consensus that preconditions for eliminating the infection in human populations have not yet been met. Projections have been made for the continuation of outbreaks beyond 2022. As many COVID-19 vaccines have been administered to the general public with updated versions targeting at new variants, community health workers and psychologists have started to focus on understanding the factors affecting individuals' preferences regarding vaccination. Attention must be given to ethnic minority groups, which are underrepresented in COVID-19-related studies (Etti et al., 2021; National Institute for Health Research, 2021).

In the United States, people of various ethnic and racial backgrounds are showing different attitudes towards COVID-19 vaccines, as reflected in their vaccine uptake. American Indians and Asians, who are ethnic minorities in the country, show the highest vaccination rates, not White Americans (Centre for Disease Control and Prevention, 2021). This phenomenon suggests that being an ethnic or racial minority is not necessarily a barrier to COVID-19 vaccine acceptance. In contrast, White British in the United Kingdom is the most-vaccinated group (Office for National Statistics, 2021). Research needs to go beyond ethnic or racial categorization to understand why such variation exists. This information is valuable because it supports the tailoring of messages that consider cultural differences to encourage COVID-19 vaccination behaviors (Grimm et al., 2021).

This study focuses on South Asian ethnic minorities in the context of Hong Kong and examines the individual-level factors (perception of healthcare, religious belief, and socioeconomic status) associated with their perception of the benefits and risks of COVID-19 vaccines. Hong Kong is a cultural melting pot home to global citizens from all over the world. South Asian ethnic minorities have their own cultural beliefs and practices, religious preferences, distinct experiences with the healthcare system, and unique socioeconomic characteristics that call for a COVID-19 vaccine campaign specifically designed to speak to them. More importantly, South Asians were stigmatized for cluster outbreaks, which revealed the Hong Kong health authorities' lack of cultural awareness and sensitivity to ethnic minority groups. This study uses Hong Kong as an example to highlight the complexity of cultural variations in global metropolitan cities and to underscore the importance of adapting public health messages to different communities' preferences and needs.

1.1 | The behavioral model of health service use

We adopted the behavioral model of health service use as the guiding framework to select relevant variables for inclusion in the current analysis (R. M. Andersen, 1995; R. Andersen & Newman, 1973). Anderson theorized that societal determinants, the healthcare system, and individual factors together affect healthcare utilization (R. M. Andersen, 1995; R. Andersen & Newman, 1973). Societal and healthcare system factors are macro-level determinants concerning advances in medical technology and social norms and to the resources and organization of healthcare systems, respectively.

According to the theory, three fundamental individual factors also affect the utilization of healthcare: predisposing, enabling, and need factors (R. M. Andersen, 1995; R. Andersen & Newman, 1973). Predisposing factors refer to individuals' characteristics, such as demographics (e.g., religion and ethnicity), socioeconomic status (e.g., education level and occupation), and personal perceptions concerning healthcare (e.g., trust in healthcare). These determinants affect personal decisions on obtaining and choosing health services. Enabling factors are personal and community resources that promote access to effective healthcare. Health insurance is an example of a personal resource. Examples of community resources are community clinics providing inexpensive or free health services or local social service centers bridging health and social care. Need factors are the perceived health conditions of an individual: The greater the need, the greater the usage.

This study examined the effect of the predisposing factors of South Asians' perceptions of healthcare, religious beliefs, and socioeconomic factors on their perception of the benefits and risks of COVID-19 vaccination in Hong Kong.
Because the behavioral model was designed to explain health service use behaviors among White Americans in the 1970s, we had to adapt it to South Asians’ specific experiences as an ethnic minority population in Hong Kong (Bindman et al., 2021; Gelberg et al., 2000). The following reviews the socioeconomic and cultural characteristics of South Asians, which determine the specific predisposing predictors for this study.

1.2 South Asian ethnic minorities in Hong Kong

Approximately 8% of the total population of Hong Kong comprises non-Chinese ethnic minorities, both locally born and immigrants individuals (Census & Statistics Department, 2016). South Asians, including Indians, Pakistanis, Nepalis, Bangladeshis, and Sri Lankans, represent one of the most prominent ethnic minority groups in Hong Kong, accounting for 14.5% of the total Hong Kong ethnic minority population (Census & Statistics Department, 2016). Indians, Pakistanis, and Nepalis are the largest ethnic subgroups of the South Asian community.

During the COVID-19 pandemic, South Asians have been being blamed for a cluster outbreak and singled out by the government as a community that fails to observe social distancing rules (Paul & Lam, 2021). Such comments from the healthcare authorities not only stirred up negative sentiments among the South Asian community but also reflected a lack of cultural awareness among Hong Kong healthcare professionals more generally (Paul & Lam, 2021). An earlier study also showed that South Asians tended to perceive the healthcare system as less responsive to their needs than to those of majority Chinese, noting communication barriers with healthcare service providers, having lower access to community service support, and experiencing lower levels of autonomy when they choose their healthcare provider (Vandan et al., 2020). Their feeling of being excluded from the healthcare system may negatively affect their perception of COVID-19 vaccines (Bindman et al., 2021; Lindholt et al., 2021; Razai et al., 2021). Hence, we hypothesized that trust in the healthcare system will affect their perception of the benefits and risks of COVID-19 vaccines.

Having a healthcare system that actively involves and engages patients is associated with higher levels of patient trust (Palumbo, 2016; Palumbo et al., 2019), which is also associated with a higher level of COVID-19 vaccine acceptance (e.g., Solís Arce et al., 2021; Wong et al., 2021). Drawing on the South Asians’ cultural strengths of prioritizing the interests of their ethnic community over individual gains, that is, collective ethnic community (McPherson et al., 2014), we also hypothesized that South Asians’ level of involvement in improving their community health will affect their perception of the benefits and risks of COVID-19 vaccines.

Even though South Asians are categorized as one ethnic group in Hong Kong, there are variations among them. Culturally, Hinduism and Islam are the two major religions adhered to by Indians, Pakistanis, and Nepalis (Erni & Leung, 2014). At the same time, a significant proportion of Nepalis and Sri Lankans are practicing Buddhists and Christians. Followers of different religions adopt different values and beliefs, which may affect their perceptions of COVID-19. Religious beliefs, such as the idea that COVID-19 is part of God’s plan (Pelcic et al., 2016) or that the individual’s health depends on God’s power (Olagoke et al., 2021), have been found to be associated with vaccine hesitation. For example, orthodox Christians tend to refuse vaccine as they believe that it is an act of interfering with divine providence (Olagoke et al., 2021; Pelcic et al., 2016). On the other hand, followers of Islam, Hinduism, and Buddhism tend to accept vaccine if it adheres to their religious principles, such as the halal status of the vaccine and the production of it does not involve the killing of living organisms (Mahdi et al., 2016; Pelcic et al., 2016). Olagoke et al. (2021) also found that individuals who were more religious tended to believe the pandemic is an act of God that human had no control over, which adversely affected their intention to be vaccinated. Considering that religion is part of the daily life of many South Asians in Hong Kong, we hypothesized that belief in COVID-19 as part of the course of nature and God’s plan will affect South Asians’ perception of the benefits and risks of COVID-19 vaccines.

Socioeconomically speaking, amongst the South Asian group, Indians have the highest income and education level, while Nepalis suffer from relative socioeconomic disadvantage (Census & Statistics Department, 2016).
Furthermore, some South Asians have already earned their residency in Hong Kong while others still have new immigrant status (Census & Statistics Department, 2016). Findings from other regions of the world show have associated vaccine hesitancy with low socioeconomic status (e.g., Okubo et al., 2021; Robertson et al., 2021; Wang et al., 2021). As differences in socioeconomic status are found among the South Asian population in Hong Kong, we hypothesized that South Asians of different socioeconomic status differ in their perception of the benefits and risks of COVID-19 vaccines.

2 | METHODS

2.1 | Participants and sampling

A cross-sectional survey design (n = 245 South Asian adults) was used in this study. Participants had to be South Asians over 18 years old residing in Hong Kong during the study. Our participants were selected from among the membership of three community-based organizations in Hong Kong. All these organizations are non-profit in nature and have a history of providing outreach and center-based social support services for South Asians in Hong Kong. Services are provided by teams of social workers and community assistants comprised of ethnic Chinese and South Asians. Their service areas cover all districts of Hong Kong and thus their members reside in different areas of the city.

For the sampling procedures, first, a combined list of 1050 South Asian members of the three organizations was employed as the sampling frame of this study. An online survey was then sent to everyone on the membership list via WhatsApp, a key communication app used by community workers and their clients during the Covid-19 pandemic. Two waves of follow-up reminders were sent to everyone on the membership list to encourage responses. As South Asians in Hong Kong are a hard-to-reach population, it was not practical to use a random telephone survey to reach participants. Furthermore, complying with social distancing measures, our team decided to opt for online instead of face-to-face interviews. Thus, we relied on the community-based organizations to distribute the survey to their members via social media channels.

2.2 | Procedures and ethics

Ethical approval was first obtained via the Survey and Behavioral Research Committee of the corresponding author’s university (Reference no. SBRE-20-534). After receiving approval, the team contacted our community partners to send out messages to their members. Upon receiving the notification via WhatsApp, participants were first asked to select their preferred language for the survey (i.e., English, Hindi, Nepali, or Urdu) and then click on the survey link to access the electronic consent form and survey. Those who completed the survey received a grocery coupon worth HKD 50 (USD 6.5). To avoid duplicate responses, we asked each respondent to provide unique identifiers and contact information to receive the incentive.

2.3 | Survey instruments

A panel comprising public health and social work researchers as well as representatives from South Asian communities was formed to develop the questionnaire. The survey was first compiled in English and translated to Hindi, Urdu, and Nepali by three translators proficient in these languages. The research team, which consists of members fluent in these languages, then back-translated the survey into English to check consistency. The questionnaire was tested among 20 South Asians who speak the relevant languages. Revisions were made based on their feedback.
2.3.1 | Outcome variables

There were five outcome variables, three representing perceived benefits of COVID-19 vaccines and two representing perceived risks. Three items tapped into the perceived benefits of COVID-19 vaccines on the individual, family, and society levels, with categorical responses (yes = 1, no = 2, not sure = 3). The items were “Taking a COVID-19 vaccine is highly effective in protecting you from COVID-19”; “Taking a COVID-19 vaccine is highly effective in protecting your family from COVID-19”; “Taking a COVID-19 vaccine is highly effective in controlling the spread of COVID-19 in Hong Kong.” Two items were used to tap into the perceived risks of COVID-19 with the same categorical responses (yes = 1, no = 2, not sure = 3). These items were “COVID-19 vaccines will have severe side effects” and “COVID-19 vaccines only have limited protective effects.” For the purposes of this study, all four variables were recoded as binary scores (yes = 1; no/not sure = 0).

2.3.2 | Perception of the healthcare system

Perception of the healthcare system was measured with two variables: Trust in the healthcare system and perceived involvement in improving the South Asian community’s health. Trust in healthcare was measured by a single item, “How much confidence do you have in Hong Kong’s healthcare system?” Participants were asked to rate this item between 1 (not at all confident) to 10 (extremely confident). A self-designed scale was used to tap into perceived involvement in improving the South Asian community’s health. The focus on community health was recommended by South Asian representatives in the research team because of the cultural orientation of putting community interests before personal health. Four items tapped into this concept with reference to existing literature on active patient involvement and self-management of health (Palumbo, 2016): “I have the opportunity to be actively involved with professionals to improve the positive health of my South Asian community”; “I believe that my strengths are valued by professionals in improving the health of my South Asian community”; “I have the opportunity to work with professionals to improve the health of my South Asian community”; “I feel that I am treated as an equal by professionals when we talk about improving the health of my South Asian community.” This self-designed measure used a 7-level response scale, ranging from “totally disagree” to “totally agree.” A higher score indicated a higher level of perceived coproduction of community health. The measure has a satisfactory level of internal consistency (α = 0.90) and demonstrated construct validity (CFI = 0.96/TLI = 0.93).

2.3.3 | Religious belief

Religious belief was measured by two items with categorical responses (yes = 1, no = 2, not sure = 3), based on the recommendations of the South Asian representatives mentioned above: “The body is sacred, and should not receive certain chemicals, or blood or tissue from animals” and “COVID-19 should be healed by God or natural means.” For the purposes of this study, the scoring of the two variables was recoded as binary (yes = 1; no/not sure = 0).

2.3.4 | Socioeconomic status

Socioeconomic status was measured with four variables: permanent Hong Kong residency (yes = 1; no = 0); education level (lower secondary or below [grade 9 or below] = 1; upper secondary [high school diploma] = 2; tertiary or above = 3); employment status (0 = unemployed; 1 = full-time employed; 2 = part-time employed; 3 = unemployed housewife; 4 = unemployed student); and marital status (single = 1; married = 2; divorced/widowed = 3).

LAI ET AL. | 5
| TABLE 1  | Descriptive statistics |
|-----------|------------------------|
|           | \( N = 245 \) | % |
| **Patient involvement and trust** | | |
| Involvement in community health | 18.28 | - |
| Trust in healthcare system | 7.23 | - |
| **Religious belief** | | |
| The body is sacred (missing = 0) | | |
| Yes | 61 | 24.90 |
| No | 184 | 75.10 |
| COVID-19 healed by God (missing = 0) | | |
| Yes | 54 | 22.04 |
| No | 191 | 77.96 |
| **Socioeconomic status** | | |
| Marital status (missing = 0) | | |
| Single | 79 | 32.24 |
| Married or cohabited | 155 | 63.27 |
| Divorced or widowed | 11 | 4.49 |
| Permanent residents (missing = 0) | | |
| Yes | 173 | 70.61 |
| No | 72 | 29.39 |
| Education (missing = 0) | | |
| Junior high or below | 35 | 14.29 |
| Senior high or equivalent | 64 | 26.12 |
| College or above | 146 | 59.59 |
| Employment (missing = 1) | | |
| Unemployed—out of jobs | 21 | 8.61 |
| Employed—full time | 93 | 38.11 |
| Employed—part time | 23 | 9.43 |
| Employed—housewife | 72 | 29.51 |
| Unemployed—students | 35 | 14.34 |
| **Demographics and covariates** | | |
| Religion (missing = 0) | | |
| Hindu | 73 | 29.80 |
| Islam | 119 | 48.57 |
| Sikhism | 9 | 3.67 |
| Buddhism | 19 | 7.76 |
| Christianity | 14 | 5.71 |
| Others | 11 | 4.49 |
2.3.5 Covariates

Covariates included participants' demographic characteristics and health status. Demographic characteristics include gender, age, ethnicity, and religion. Health status was measured with a single binary item (yes = 1; no = 0): "Have you been diagnosed with a chronic disease by a doctor?"

2.4 Analysis

The five outcome variables were dichotomous in nature. Univariate analysis was used to obtain the descriptive statistics. Bivariate analysis was employed to explore the bivariate relationships between the variable of interest and the predictors. Lastly, multivariate logistic regression was used to test the hypotheses. As this study has five outcome variables, five logistic regressions were employed. Odds ratios and their 95% confidence intervals were obtained. Stata version 16.1 was used.

3 RESULTS

3.1 Participants' characteristics

Table 1 shows the participants' characteristics. A total of 245 participants completed the survey (male = 34%; female = 66%). Approximately 34% were aged between 18 and 29, 41% between 30 and 39, 22.5% between 40 and 49, and 2.87% over 50. Among the respondents, 34% were Indian, 36% were Pakistani, and 21% were Nepali.
### TABLE 2  Perceived benefits and predictors

|                                | Benefit individual | Benefit family | Benefit HK |
|--------------------------------|--------------------|---------------|------------|
|                                | Yes (N = 130)      | No (N = 115)  | F-value/χ² |
| Involvement in community health| 20.13              | 16.22         | 1.94*      |
|                                | 19.96              | 16.23         | 2.08*      |
|                                | 19.18              | 16.62         | 1.72*      |
|                                | -                  | -             | 4.15*      |
|                                | 7.78               | 6.62          | 3.20*      |
|                                | 7.88               | 6.43          | 4.81*      |
|                                | 7.61               | 6.55          | 2.47*      |
| Religious belief               |                    |               |            |
| The body is sacred             | -                  | -             | 7.69*      |
|                                | -                  | -             | 8.59*      |
|                                | Yes                | 23            | 38         |
|                                | 24                 | 37            | -          |
|                                | No                 | 107           | 77         |
|                                | -                  | -             | 112        |
|                                | -                  | -             | 72         |
|                                | -                  | -             | 126        |
|                                | -                  | -             | 58         |
| COVID-19 healed by God         | -                  | -             | 3.04       |
|                                | -                  | -             | 0.37       |
|                                | Yes                | 23            | 31         |
|                                | 28                 | 26            | -          |
|                                | No                 | 107           | 84         |
|                                | -                  | -             | 108        |
|                                | -                  | -             | 83         |
|                                | -                  | -             | 130        |
|                                | -                  | -             | 61         |
| Socioeconomic status           |                    |               |            |
| Marital status                 | -                  | -             | 1.62       |
|                                | Single             | 38            | 41         |
|                                | Married or cohabited| 87           | 68         |
|                                | Divorced or widowed| 5            | 6          |
|                                | -                  | -             | 7          |
|                                | -                  | -             | 4          |
|                                | -                  | -             | 8          |
|                                | -                  | -             | 3          |
| Permanent residents            | -                  | -             | 2.65       |
|                                | Yes                | 86            | 87         |
|                                | 47                 | 25            | -          |
|                                | No                 | 44            | 28         |
|                                | -                  | -             | 89         |
|                                | -                  | -             | 84         |
|                                | -                  | -             | 101        |
|                                | -                  | -             | 72         |
| Education                      | -                  | -             | 0.93       |
|                                | Junior high or below| 17           | 18         |
|                                | Senior high or equivalent| 37         | 27         |
|                                | College or above   | 76            | 70         |

* indicates statistical significance at *p < 0.05
| TABLE 2 (Continued) | Benefit individual | Benefit family | Benefit HK |
|----------------------|-------------------|---------------|------------|
| Employment           |                   |               |            |
| Unemployed—out of jobs | 12 | 9 | - | 16 | 5 | - | 16 | 5 | - |
| Employed—full time   | 45 | 48 | - | 46 | 47 | - | 63 | 30 | - |
| Employed—part time   | 11 | 12 | - | 12 | 11 | - | 14 | 9 | - |
| Employed—housewife   | 39 | 33 | - | 41 | 31 | - | 46 | 26 | - |
| Unemployed—students  | 22 | 13 | - | 20 | 15 | - | 19 | 16 | - |
| Employment           |                   |               |            |
| Demographics and covariates |       |               |            |
| Religion             |                   | 14.46*        |            |
| Hindu                | 46 | 27 | - | 42 | 31 | - | 56 | 17 | - |
| Islam                | 50 | 69 | - | 56 | 63 | - | 67 | 52 | - |
| Sikhism              | 5  | 4  | - | 7  | 2  | - | 7  | 2  | - |
| Buddhism             | 13 | 6  | - | 15 | 4  | - | 11 | 8  | - |
| Christianity         | 11 | 3  | - | 10 | 4  | - | 11 | 3  | - |
| Others               | 5  | 6  | - | 6  | 5  | - | 7  | 4  | - |
| Ethnicity            |                   | 4.61          |            |
| Indian               | 47 | 36 | - | 50 | 33 | - | 63 | 20 | - |
| Pakistani            | 43 | 46 | - | 46 | 43 | - | 56 | 33 | - |
| Nepali               | 32 | 20 | - | 31 | 21 | - | 31 | 21 | - |
| Other ethnic groups  | 8  | 13 | - | 9  | 12 | - | 9  | 12 | - |
|                      |                   |               |            |
| (Continues)          |                   |               |            |
| Benefit individual | Benefit family | Benefit HK |
|--------------------|----------------|------------|
| Yes (N = 130) | No (N = 115) | F-value/χ² | Yes (N = 109) | No (N = 136) | F-value/χ² | Yes (N = 86) | No (N = 159) | F-value/χ² |
| Chronic disease | | | | | | | | |
| Yes | | | | | | | | |
| No | 119 | 102 | - | 124 | 97 | 145 | 76 | - |
| Gender | | | | | | | | |
| Female | 81 | 81 | - | 86 | 76 | - | 103 | 59 | - |
| Male | 49 | 34 | - | 50 | 33 | - | 56 | 27 | - |
| Age | | | | | | | | |
| 18-29 | 36 | 46 | - | 39 | 43 | - | 42 | 40 | - |
| 30-39 | 62 | 38 | - | 62 | 38 | - | 76 | 24 | - |
| 40-49 | 30 | 25 | - | 32 | 23 | - | 37 | 18 | - |
| 50 or above | 1 | 6 | - | 2 | 5 | - | 3 | 4 | - |

*p < 0.05.
| TABLE 3 Perceived risks and predictors |
|---------------------------------------|
|                                       |
| **Patient involvement and trust**     |
| Involvement in community health       | 18.22 | 18.31 | 1.49 | 18.22 | 18.31 | 1.10 |
| Trust in healthcare system            | 6.91  | 7.36  | 0.79 | 6.91  | 7.36  | 1.45 |
| **Religious belief**                  |
| The body is sacred                    |       |       | 23.69* |       |       | 3.92 |
| Yes                                   | 32    | 29    |       | 32    | 29    |       |
| No                                    | 37    | 147   |       | 37    | 147   |       |
| COVID-19 healed by God                |       |       | 3.93* |       |       | 14.09* |
| Yes                                   | 21    | 33    |       | 21    | 33    |       |
| No                                    | 48    | 143   |       | 48    | 143   |       |
| **Socioeconomic status**              |
| Marital status                        |       |       | 1.64 |       |       | 3.90 |
| Single                                | 26    | 53    |       | 26    | 53    |       |
| Married or cohabited                  | 41    | 114   |       | 41    | 114   |       |
| Divorced or widowed                   | 2     | 9     |       | 2     | 9     |       |
| Permanent residents                   |       |       | 2.70 |       |       | 1.71 |
| Yes                                   | 15    | 57    |       | 15    | 57    |       |
| No                                    | 54    | 119   |       | 54    | 119   |       |
| Education                             |       |       | 3.13 |       |       | 4.58 |
| Junior high or below                  | 12    | 23    |       | 12    | 23    |       |
| Senior high or equivalent             | 22    | 42    |       | 22    | 42    |       |
| College or above                      | 35    | 111   |       | 35    | 111   |       |
| Employment                            |       |       | 5.28 |       |       | 4.79 |
| Unemployed—out of jobs                | 6     | 15    |       | 6     | 15    |       |
| Employed—full time                    | 24    | 69    |       | 24    | 69    |       |
| Employed—part time                    | 11    | 12    |       | 11    | 12    |       |
| Employed—housewife                    | 21    | 51    |       | 21    | 51    |       |
| Unemployed—students                   | 7     | 28    |       | 7     | 28    |       |
| **Demographics and covariates**       |
| Religion                              |       |       | 21.01* |       |       | 3.69 |
| Hindu                                 | 15    | 58    |       | 15    | 58    |       |
| Islam                                 | 29    | 90    |       | 29    | 90    |       |
| Sikhism                               | 1     | 81    |       | 1     | 81    |       |

(Continues)
Approximately 71% were permanent residents of Hong Kong. In terms of education, 14.3% had a lower secondary education or below, 26.1% had an upper secondary education, and 59.6% were college graduates or above. Approximately 32.2% were single, 63.3% were married, and 4.5% were divorced or widowed. The majority of the respondents were Muslim (48.6%), followed by Hindus (29.7%), Buddhists (7.8%), Christians (5.7%), Sikhs (3.7%), and others (4.9%). Regarding their health status, close to 10% reported having at least one chronic disease.

### 3.2 Perceived benefits and risks

Table 2 shows the bivariate results of the perceived benefits and risks of COVID-19 vaccines according to their predisposing factors. Regarding the perceived benefits, 53% of the respondents agreed that the vaccines can protect them, 55% agreed that they can protect their family, and 64% believed that the vaccines can control the spread of COVID-19 in Hong Kong. For the perceived risks, 28% believed that COVID-19 vaccines will incur severe side effects, 22% believed that the vaccines only have limited effects, and 8.5% thought it was difficult to obtain a vaccine.

The model statistics and parameter estimate of the logistic regressions with the five different outcomes representing perceived benefits and risks are presented in Tables 3 and 4. All models showed satisfactory model fit
| TABLE 4  | Logistic regression results in perceived benefits of COVID-19 vaccine |
|----------|---------------------------------------------------------------------|
|          | Perceived benefit vaccine (individual)                             | Perceived benefit vaccine (family)                  | Perceived benefit vaccine (society)               |
|          | b         | 95% CI     | ORs | b         | 95% CI     | ORs | b         | 95% CI     | ORs |
| Intercept| -3.85     | -7.87, -0.17 | 0.02 | -4.08     | -8.18, 0.02 | 0.02 | -3.22     | -7.29, 0.84 | 0.04 |
| **Patient involvement and trust** | | | | | | | | |
| Involvement in community health | 0.09*     | 0.03, 0.15 | 1.10* | 0.09*     | 0.02, 0.15 | 1.09* | 0.04     | -0.02, 0.10 | 1.04 |
| Trust in healthcare system | 0.20*     | 0.02, 0.38 | 1.23* | 0.33*     | 0.14, 0.52 | 1.39* | 0.21*     | 0.03, 0.38 | 1.23* |
| **Religious belief** | | | | | | | | |
| The body is sacred | -0.83     | -1.72, 0.05 | 0.43 | -1.11*     | -2.03, -0.19 | 0.33* | -0.24     | -1.04, 0.56 | 0.79 |
| COVID-19 healed by God | -0.39     | -1.32, 0.54 | 0.68 | 0.09      | -0.87, 1.05 | 1.09 | -0.42     | -1.31, 0.47 | 0.65 |
| **Socioeconomic status** | | | | | | | | |
| Marital status (single = 0) | | | | | | | | |
| Married/cohabited | 0.63     | -0.47, 1.72 | 1.87 | -0.24     | -1.33, 0.85 | 0.79 | 0.54     | -0.48, 1.57 | 1.72 |
| Divorced and widowed | -0.26     | -2.12, 1.61 | 0.77 | -0.03     | -1.99, 1.93 | 0.97 | 1.01     | -0.91, 2.93 | 2.75 |
| Permanent residents (yes = 1) | 0.74     | -0.15, 1.64 | 2.13 | 1.27*     | 0.35, 2.18 | 3.55* | 1.27*     | 0.35, 2.19 | 3.55* |
| Education (≥lower secondary =0) | | | | | | | | |
| Upper secondary | 0.07     | -1.09, 1.23 | 1.08 | 0.26      | -0.90, 1.43 | 1.30 | -0.32    | 1.39, 0.75 | 0.73 |
| College/university or above | -0.66    | -1.78, 0.47 | 0.52 | -0.38     | -1.49, 0.73 | 0.68 | -0.08    | -1.11, 0.94 | 0.92 |
| Employment (unemployed—out of jobs = 0) | | | | | | | | |
| Employed—full time | -0.66     | -2.13, 0.81 | 0.52 | -1.33     | -2.78, 0.13 | 0.27 | -0.66     | -2.09, 0.76 | 0.52 |
| Employed—part time | -0.49     | -2.25, 1.27 | 0.61 | -0.50     | -0.22, 1.26 | 0.61 | -0.43     | 2.15, 1.29 | 0.65 |
| Employed—housewife | 0.04     | -1.53, 1.62 | 1.04 | -0.25     | -1.80, 1.31 | 0.78 | -0.63     | 2.13, 0.87 | 0.53 |
| Unemployed—students | 1.79*    | 0.11, 3.48 | 6.01* | -0.05     | -1.68, 1.59 | 0.95 | -0.07     | -1.61, 1.47 | 0.93 |

(Continues)
| Demographics and covariates | Perceived benefit vaccine (individual) | Perceived benefit vaccine (family) | Perceived benefit vaccine (society) |
|-----------------------------|--------------------------------------|-----------------------------------|-------------------------------------|
|                             | $b$ | 95% CI   | ORs | $b$ | 95% CI   | ORs | $b$ | 95% CI   | ORs |
| **Religion (Hindu = 0)**    |     |           |     |     |           |     |     |           |     |
| Muslim                      | −1.63* | −2.92, −0.35 | 0.20* | −0.69 | −1.97, 0.59 | 0.50 | −1.20 | −2.54, 0.14 | 0.30 |
| Sikhism                     | 0.32 | −1.55, 2.19 | 1.38 | 2.48* | 0.14, 4.92 | 11.90* | 1.04 | −1.13, 3.22 | 2.84 |
| Buddhism                    | 0.33 | −1.21, 1.87 | 1.40 | 2.18* | 0.48, 3.89 | 8.88* | −0.16 | −1.56, 1.24 | 0.85 |
| Christianity                | 1.04 | −0.80, 2.87 | 2.82 | 0.76 | −0.87, 2.40 | 2.14 | 0.55 | −1.39, 2.50 | 1.74 |
| Others                      | −0.41 | −2.07, 1.26 | 0.66 | 1.05 | −0.66, 2.76 | 2.86 | 0.47 | −1.17, 2.11 | 1.61 |
| **Ethnicity (Indian = 0)**  |     |           |     |     |           |     |     |           |     |
| Pakistani                   | 1.38* | 0.23, 2.53 | 3.98* | 1.26* | 0.11, 2.41 | 3.53* | 1.23* | 0.10, 2.35 | 3.41* |
| Nepali                      | 0.17 | 1.14, 1.48 | 1.18 | −0.28 | −1.61, 1.05 | 0.75 | −0.63 | −1.97, 0.70 | 0.53 |
| Other ethnicity groups      | 0.11 | −1.30, 1.51 | 1.11 | −0.44 | −1.84, 0.96 | 0.64 | −0.92 | −2.27, 0.42 | 0.40 |
| Having chronic disease (yes = 1) | 0.83 | −0.26, 1.92 | 2.29 | 0.27 | −0.82, 1.36 | 1.31 | 0.31 | −0.77, 1.38 | 1.36 |
| Gender (female = 1)         | −1.09* | −1.97, −0.20 | 0.34* | −0.88 | −1.76, 0.01 | 0.41 | −0.13 | −1.01, 0.75 | 0.88 |
| **Age group (18–29 = 0)**   |     |           |     |     |           |     |     |           |     |
| 30–39                       | 0.86 | −0.09, 1.81 | 2.36 | 0.77 | −0.21, 1.76 | 2.16 | 0.81 | −0.13, 1.75 | 2.25 |
| 40–49                       | 0.90 | −0.21, 2.02 | 2.47 | 0.82 | −0.31, 1.96 | 2.28 | 0.83 | −0.25, 1.90 | 2.29 |
| 50 or above                 | −1.47 | −4.12, 1.19 | 0.23 | 0.14 | −1.91, 2.18 | 1.15 | −0.04 | −1.94, 1.87 | 0.96 |

Model fit

| Pseudo $R^2$ | Hosmer–Lemeshow $X^2$ | Pseudo $R^2$ | Hosmer–Lemeshow $X^2$ | Pseudo $R^2$ | Hosmer–Lemeshow $X^2$ |
|--------------|------------------------|--------------|------------------------|--------------|------------------------|
| 0.25         | 14.36                  | 0.26         | 4.85                   | 0.19         | 9.83                   |

Abbreviation: CI, confidence interval.

*p < 0.05.
statistics. The following presents the key findings with respect to the outcomes of interest. Figures 1–5 illustrate the odds ratios of the variables associated with perceived benefits and risks.

### 3.2.1 | Perception of the healthcare system

Trust in the healthcare system was associated with perceived benefits on the individual, family, and society levels. For every unit increase in trust, individuals’ odds of perceiving the vaccine as effective in protecting their own health and that of their family increased by 22% and 39%, respectively. The odds of perceiving the vaccine as being able to control the spread of COVID-19 in Hong Kong increased by 21%. Higher levels of perceived involvement in improving South Asian community’s health were associated with perceived benefits on the individual and family levels but not the society level. For every unit increase in the score of perceived involvement in community health, the odds of reporting perceived vaccine benefits on the individual and family levels both increased by 9.5%. Perception of healthcare was not associated with perceived risks of the vaccine.

### 3.2.2 | Religious belief

Among those who considered their body sacred, their odds of reporting the vaccine as beneficial on the individual level were 68% lower than those who did not see their body as sacred. This group of South Asians was also 5.8 times more likely to perceive COVID-19 vaccines as bearing severe risk. Those who believed that COVID-19 would be cured by GOD were seven times more likely to believe that the vaccines only offer limited protection.
3.2.3 | Socioeconomic factors

Permanent resident and student status (vs. unemployed) were significant predictors of perceived vaccine benefits and risks. Permanent residents were 3.8 times more likely to report benefits on the family level and 4.3 times more likely to report benefits on the society level than non-residents. Students were six times more likely to see vaccines as beneficial on the individual level than those who were unemployed. Regarding risks, those who had upper secondary or college education or above were 6.8 times and 9.5 times more likely, respectively, to believe that the vaccines offer only a limited protective effect than those with lower levels of education.

3.2.4 | Demographics and covariates

The demographic factors of ethnicity, religion, and gender were significant predictors whereas the need factors of health status were not. Regarding ethnicity, Pakistanis were nearly four times more likely than Indians to report vaccines as being effective in protecting one's own health, 3.5 times more likely to indicate that vaccines can protect their family, and 3.3 times more likely to perceive vaccines as beneficial on the society level. Buddhists and Sikhs were 9 times and 12 times more likely, respectively, to report perceiving benefits on the family level versus Hindu. Buddhists were also six times more likely than Hindus to perceive that the vaccines have severe risks. Muslims were 81% less likely than Hindus to report perceived vaccine benefits on the individual level. Lastly, women were 67% less likely than male respondents to report vaccine benefits on the individual level.
FIGURE 3  Odds ratio of variables associated with perceived benefits on society level

FIGURE 4  Odds ratio of variables associated with perceived risks: severe risk of vaccine
DISCUSSION

According to the behavioral health model of health service use (R. M. Andersen, 1995; R. Andersen & Newman, 1973), this study found that perceptions about healthcare, religious beliefs, and socioeconomic and demographic factors affect South Asians’ perception of the benefits and risks of COVID-19 vaccines in Hong Kong. The findings underscore the importance of recognizing the distinct values and preferences regarding COVID-19 vaccines within a large ethnic community. Such diversity will impact their health service use profile, including their decision to accept or reject COVID-19 vaccines. Even among a single ethnic minority group, there are no “one size fits all” messages that can effectively convey messages about COVID-19 vaccines.

Consistent with the literature (Lindholt et al., 2021; Razai et al., 2021), trust in the healthcare system is a statistically significant predictor of South Asian attitudes towards COVID-19 vaccines. We also found that perceived involvement in own community health, a unique cultural strengths of South Asians, plays a role (McPherson et al., 2014). Such findings imply the need to create a more inclusive and culturally relevant healthcare system to facilitate the promotion of COVID-19 vaccination campaigns among the South Asian community in Hong Kong in the long run (Grimm et al., 2021). A healthcare system that considers the cultural strength of collective ethnic community and that actively engages and values the input of ethnic minorities will greatly enhance the effectiveness of public health messages to these populations (Palumbo, 2016; Palumbo et al., 2019). Involving ethnic minorities in the design and delivery healthcare services is a form of empowerment that can positively change their health behaviors and drive up their levels of trust in healthcare (Palumbo, 2016; Palumbo et al., 2019).

FIGURE 5   Odds ratio of variables associated with perceived risks: limited-effect of vaccine

4   |   DISCUSSION
Even though the redesigning of a culturally inclusive healthcare system will take a long time, it is necessary, especially given that the COVID-19 pandemic is expected to see resurgences with more transmissible variants in the coming years. The establishment of a healthcare system that respect differences, with workers who are aware of the complexity of cultural diversity (Grimm et al., 2021), is particularly important in Hong Kong, where health authorities have been criticized for being culturally insensitive and inappropriate both before and during the pandemic (Paul & Lam, 2021).

Religious belief is found to be associated with perception of the benefits and risks of the vaccines. In line with the literatures (Olagoke et al., 2021; Pelcic et al., 2016), seeing the body as sacred affected South Asians' perception of the vaccines as involving severe risks and believing that God will cure COVID-19 was associated with an inclination to see vaccines as offering only limited protection. Community health workers and psychologists in interethnic settings need to embrace the religious values cherished by South Asians and respect such cultural diversity. Merely conveying scientific facts and disregarding religious beliefs may have unintended negative consequences. Engaging religious leaders may help reduce believers' conflictual feelings about following the course of nature versus actively fighting the virus with the vaccines.

This study also identifies socioeconomic characteristics associated with South Asians' perception of COVID-19 vaccines. Permanent resident status was related to higher odds of reporting perceived vaccine benefits on the family and society levels, but not on the individual level. Permanent residency may imply a sense of belonging to Hong Kong. Thus, permanent residents value the protective effect of the vaccines on the broader levels of family and society. This result, again, points to the cultural strengths of having a collective ethnic community among ethnic minorities, suggesting importance of community involvement in COVID-19 vaccine campaigns (Palumbo, 2016; Palumbo et al., 2019). Regarding perceived risks, those who are more educated tend to believe that COVID-19 vaccines have limited protective effects only. While this concern is valid to a certain extent, community health workers and psychologists can consider providing additional empirical information, such as the fact that vaccines successfully reduce the chances of developing complications, so that educated South Asians can make an informed decision for themselves and their families.

Demographically, different factors were found to be associated with perceived vaccine benefits on various levels, that is, individual, family, and society. For example, Pakistanis are more likely than Hindus to report perceived benefits on all levels, while more men than women only see the vaccines as offering benefits on the individual level. Differences also exist across different religious affiliations. Muslims are less likely to see the vaccine as effective in protecting personal health, while Buddhists and Sikhs tend to perceive vaccines as effective in protecting their family. Interestingly, Buddhists also regard the vaccines as having severe side effects. This set of results again points to the fact that subgroup variation exists within a large ethnic minority group. Community health workers need respect individual differences when delivering COVID-19 vaccination messages, for example talking about the benefits of vaccines on the family and society levels among Pakistanis. At the same time, they must be mindful not to categorize ethnic minorities as pro- or anti-vaccine based on their demographic profile.

4.1 Limitations

The results of this study should be interpreted in light of the following limitations. The first is generalizability of the findings. The study has the relatively low response rate with the use of an online survey. The online survey yielded a sample of participants that is relatively young and healthy: Approximately 98% were aged between 18 and 50, and only 10% reported having a chronic disease. The use of convenient sampling with online survey may also lead to reporting bias, whereby only the more active individuals are included. The findings of this study may not be entirely generalizable to South Asian individuals who are more isolated and rarely engage with their community. However, due to the social distancing measures imposed by the pandemic, including irregular operation hours for community organizations and limited client access, our team was not able to personally reach out to our target participants for
| TABLE 5 | Logistic regression results in perceived risks of COVID-19 vaccine |
|---------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                                | **Severe risk of vaccine** | **Vaccine short-term effect** |                                |                                |
|                                | \( b \) | 95% CI | ORs | \( b \) | 95% CI | ORs |
| Intercept                       | 0.37 | -3.76, 4.50 | 1.45 | -3.66 | -8.12, 0.79 | 0.03 |
| **Patient involvement and trust** | | | | | | |
| Involvement in community health | 0.02 | -0.05, 0.08 | 1.02 | 0.01 | -0.06, 0.08 | 1.01 |
| Trust in healthcare system     | -0.07 | -0.26, 0.12 | 0.93 | 0.02 | -0.19, 0.23 | 1.02 |
| **Religious belief**           | | | | | | |
| The body is sacred              | 1.76* | 0.90, 2.62 | 5.80 | 0.63 | -0.26, 1.52 | 1.88 |
| COVID-19 healed by God          | 0.06 | -0.91, 1.02 | 1.06 | 1.94* | 0.95, 2.93 | 6.96 |
| **Socioeconomic status**       | | | | | | |
| Marital status (single = 0)    | | | | | | |
| Married/cohabited              | -0.50 | -1.55, 0.56 | 0.61 | -0.76 | -1.89, 0.37 | 0.47 |
| Divorced and widowed           | -1.16 | -3.26, 0.94 | 0.31 | -0.38 | -2.34, 1.58 | 0.69 |
| Permanent Residents (yes = 1)  | -0.21 | -1.14, 0.72 | 0.81 | -2.82 | -1.24, 0.67 | 0.75 |
| Education (≥lower secondary = 0) | | | | | | |
| Upper secondary                | 0.55 | -0.61, 1.70 | 1.73 | 1.93* | 0.39, 3.47 | 6.88 |
| College/university or above    | 0.12 | -0.99, 1.22 | 1.12 | 2.25* | 0.73, 3.78 | 9.53 |
| Employment (unemployed—out of jobs = 0) | | | | | | |
| Employed—full time             | 0.10 | -1.34, 1.53 | 1.10 | -0.97 | -2.34, 0.40 | 0.38 |
| Employed—part time             | 0.61 | -1.08, 2.31 | 1.85 | -1.61 | -3.55, 0.33 | 0.20 |
| Employed—housewife             | 0.20 | -1.32, 1.72 | 1.22 | -1.35 | -2.84, 0.14 | 0.26 |
| Unemployed—students            | -1.18 | -2.81, 0.45 | 0.31 | -1.34 | -2.89, 0.20 | 0.26 |
| **Demographics and covariates** | | | | | | |
| Religion (Hindu = 0)           | | | | | | |
| Muslim                         | -1.00 | -2.52, 0.51 | 0.37 | 0.69 | -0.76, 2.14 | 1.99 |
| Sikhism                        | -0.61 | -3.21, 2.00 | 0.55 | -0.06 | -2.10, 1.99 | 0.95 |
| Buddhism                       | 1.82* | 0.36, 3.27 | 6.14 | -1.31 | -3.02, 0.39 | 0.27 |
| Christianity                   | 0.77 | -0.91, 2.44 | 2.16 | -0.56 | -2.64, 1.53 | 0.57 |
| Others                         | 1.55 | -0.14, 3.24 | 4.71 | -0.12 | -1.83, 1.59 | 0.89 |
| Ethnicity (Indian = 0)         | | | | | | |
| Pakistani                      | 0.90 | -0.42, 2.22 | 2.46 | -1.07 | -2.32, 0.18 | 0.34 |
| Nepali                         | 0.59 | -0.79, 1.98 | 1.81 | 1.31 | -0.11, 2.73 | 3.70 |
| Other ethnicity groups         | 1.21 | -0.33, 2.75 | 3.36 | -0.44 | -2.01, 1.14 | 0.65 |
| Having chronic disease (yes = 1) | -0.36 | -1.45, 0.74 | 0.70 | 0.19 | -1.05, 1.44 | 1.21 |
| Gender (female = 1)            | -0.34 | -1.27, 0.58 | 0.71 | 0.65 | -0.31, 1.60 | 1.91 |
face-to-face interviews in a timely manner. As such, we can only resort to the use of online survey, while recognizing the potential limitation. In an attempt to mitigate this, the research team offered an incentive and also sent out two waves of reminders to encourage participation. Second, our respondents are relatively diverse in terms of religious affiliation, but with only small numbers of Buddhists, Christians, and Sikhs. The findings on the effect of religious affiliation on the perceived benefits and risks of the vaccine only describe their different perceptions of COVID-19 vaccines without adding much information on how specific religious views become a contributing factor. As such, we must be careful and not categorize people of different religious affiliations as more or less willing to be vaccinated when interpreting the findings.

5 | CONCLUSION

This study has examined factors affecting the perceptions of COVID-19 vaccines among South Asians in Hong Kong, a population that is underrepresented in COVID-19 research. Three key insights that can facilitate the ongoing COVID-19 vaccination promotion campaign are generated: (1) design a healthcare system that considers the cultural strength of collective ethnic community and empowers ethnic minorities by involving them in the design and delivery of healthcare services; (2) respecting cultural diversity, especially ethnic minorities' religious values and tailoring messages to fit their beliefs; (3) respecting that human diversity exist within ethnic minority subgroups and being mindful not to categorize ethnic minorities as pro- or anti-vaccine based on their demographic status. The findings provide valuable information for community health workers, community psychologists, and health authorities on how they should frame messages relating to COVID-19 vaccines targeting this ethnic minority group in Hong Kong. The findings are also useful for cross-cultural community research in providing an initial conceptualization model on how to approach specific ethnic and racial populations (Table 5).

ACKNOWLEDGMENT

This study is supported by the Center for Health Systems and Policy Research at the Chinese University of Hong Kong.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author.
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How to cite this article: Lai, A. H.-y., Wang, J. Z., Singh, A., Wong, E. L.-y., Wang, K., & Yeoh, E.-K. (2022). What determines Hong Kong South Asians’ perceptions on COVID-19 vaccine? Implications on culturally appropriate vaccine messages for ethnic minority community. *Journal of Community Psychology*, 1–23. https://doi.org/10.1002/jcop.22920