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Knowledge about COVID-19 vaccine and vaccination in Vietnam: A population survey

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Background: Coronavirus disease 2019 (COVID-19) vaccine acceptance is essential in controlling the virus. Vaccine knowledge influences vaccine acceptance and understanding this is vital in planning immunization strategies.

Objectives: This study aimed to examine the public COVID-19 vaccine knowledge levels and predictors of low knowledge levels in Vietnam.

Methods: A cross-sectional, community-based survey was conducted between April 16 and July 16, 2021. To examine the community knowledge levels regarding the vaccine essentialness and efficacy, a self-administered questionnaire was developed and comprised 7 questions with 5 Likert scale responses corresponding to the levels of agreement or disagreement with the provided statements and scores ranging from 0 to 4. An individual’s knowledge score above the mean score of all participants was defined as “acceptable” and that below was defined as “low.”

Results: Among 1708 respondents, the mean age was 34.3 ± 13.4 years, 942 (55.2%) were females, and 787 (46.7%) had acceptable knowledge levels. Age (adjusted odds ratio [AOR] 0.984 [95% CI 0.972–0.995], \( P = 0.005 \)) and being vaccinated against COVID-19 (0.653 [0.431–0.991], \( P = 0.045 \)) were inversely associated with lower knowledge levels. Those with a Gapminder income of $8 to <$15 per day (1.613 [1.117–2.329], \( P = 0.001 \)), $2 to <$8 (2.093 [1.313–3.335], \( P = 0.002 \)), and <$2 (3.341 [1.951–5.722], \( P < 0.001 \)), less than a high school education (4.214 [1.616–10.988], \( P = 0.003 \)), and nonclinical professionals and nonhealth lecturers (1.83 [1.146–2.922], \( P = 0.01 \)) were positively associated with lower knowledge levels.

Conclusion: To ensure a successful vaccine rollout, it is crucial to improve community knowledge about vaccine essentialness and efficacy. Those who are at young age, who have low income or education levels, and working in nonclinical and nonhealth education fields should be the target of the intervention programs. Community education programs may benefit from using those who have been immunized as role models.
The objective of this study was to examine the general community’s COVID-19 vaccine knowledge and associated predictors in Vietnam. This study was important because it will assist Vietnam and comparable countries in guiding interventional measures aimed at building and maintaining community’s receptiveness of COVID-19 vaccine.

Methods

Study context

Vietnam has experienced the fourth COVID-19 wave starting on April 27, 2021. This is considered the first “real wave” with 40,609 cumulative incident cases being reported in more than half of cities (52.4%, 33 of 63) across Vietnam as of the end of the study period. Of these affected areas, Ho Chi Minh City—one of the 2 research sites for the paper-based survey—was hit hard by the outbreak with 23,913 cumulative incident cases (58.9%). Considering this situation, we were able to examine the public COVID-19 vaccine knowledge in the context of an ongoing severe COVID-19 outbreak. During this time, the AstraZeneca/Oxford COVID-19 vaccine was available to priority groups including frontline health care workers and those working in COVID-19 prevention and control. A few fatal cases related to COVID-19 vaccine were reported. Vietnam has started its largest-ever COVID-19 vaccination campaign since July 10, 2021.

Study design

A cross-sectional, anonymous survey using a self-administered questionnaire was conducted across Vietnam between April 16, 2021, and July 16, 2021. The questionnaire was administered by 2 different data collection methods including online and paper-based questionnaires. The paid SurveyMonkey platform (www.surveymonkey.com) was used for the online component of the survey given favorable characteristics of SurveyMonkey including easier access, avoidance of input and data coding errors, and faster distribution. Participants were asked to read the online participant information sheet and consent form and answer a yes-no question to confirm their willingness to participate voluntarily in the survey. After answering this question, participants were directed to complete the online questionnaire. This informed consent procedure is validated elsewhere. In the paper-based survey, participants were asked to read a hard copy of the participant information sheet and complete a written informed consent form and a hard copy of the questionnaire. Only participants who fully understood and agreed to participate in the study were enrolled in the study. Vietnamese people aged 18 years and older who were able to read and answer the survey were eligible to participate in the study. After the survey, information on the year of birth of participants was used to cross-check their age. Data of those participants aged younger than 18 years were excluded from the analysis. At the end of the data collection period, to prevent duplicate entries obtained from the online survey, entries submitted from the same Internet protocol address were separately reviewed by the researchers (M.C.D. and H.T.N.) and included in the analysis once consensus was reached. The study was approved by the Phenikaa University Ethics Committee (reference 216/Q-DHP-KHCN).

To recruit both online and paper-based participants, a snowball sampling technique was used, using the authors’
COVID-19 vaccine knowledge in Vietnam

A total of 1872 people including 1003 paper-based (53.6%) and 869 online participants (46.4%) agreed to participate in the study (Figure 1). Of these 1872 people, 164 online participants (8.8%) had missing answers and were removed from the analysis. Therefore, 1708 (91.2%) people were included in the study (Figure 1). Of these 1872 people, 164 online participants and 869 online participants (46.4%) agreed to participate in the survey and included 100 individuals (i.e., 50 participants each) from different backgrounds to help refine the final survey and confirm its validity and reliability.31 To ensure study participants’ understanding of the questionnaire, the online and paper-based surveys used a questionnaire that was written in Vietnamese. Contact details of the researchers (M.C.D. and H.T.N.) were provided so that study participants could contact for assistance.

Statistical analysis

Data were analyzed using the SPSS version 26 (IBM Corp, Armonk, NY). Continuous variables were displayed as mean ± 1 SD and range. Categorical variables were presented as a count and percentage. Study participants’ vaccine knowledge levels were defined in relation to the mean score achieved by all participants. Scores above the mean were defined as “acceptable” and those below were defined as “low.” This analysis approach has been validated elsewhere.18 Chi-square test and chi-square test for trend were used to compare categorical data. t test was used to compare continuous data. A binary logistic regression model was developed to examine predictors of a low vaccine knowledge. All independent variables were entered into the model. Alpha was set at 5% level.

Maintenance of study standard

The online survey was a part of this study. Like the online survey, the paper-based survey used the snowball sampling technique to recruit participants. Therefore, to increase the study’s transparency and possibilities for interpreting the results, this paper was reported in accordance with the recommended Checklist for Reporting Results of Internet E-Surveys42,43 and the Strengthening the Reporting of Observational Studies in Epidemiology Statement guidelines for reporting observational studies.44

Results

Baseline characteristics

A total of 1872 people including 1003 paper-based (53.6%) and 869 online participants (46.4%) agreed to participate in the study (Figure 1). Of these 1872 people, 164 online participants (8.8%) had missing answers and were removed from the analysis. Therefore, 1708 (91.2%) people were included in the study. The mean age of all participants was 34.3 ± 13.4 years (Table 1). Female participants accounted for 55.2% (942 of 1708). Contact details of the researchers (M.C.D. and H.T.N.) were provided so that study participants could contact for assistance.

[Figure 1. Flowchart of study participants.]
They fully complete the vaccination schedule. Less than one-third (20.6%, 352 of 1708) strongly disagreed that they do not need to undertake any other preventive measures after COVID-19 and 36.4% (621 of 1708) strongly disagreed that they are completely protected against COVID-19.

The knowledge score of all participants was 19.2 ± 2.8 (Table 2). Hence, a score at least 20 indicated an acceptable knowledge level of COVID-19 vaccine knowledge and accounted for 46.7% of study participants (797 of 1708). In large cities in northern Vietnam, the proportion of participants having a low knowledge level was 59.6% (31 of 52) in Bac Ninh, 59.4% (231 of 389) in Hanoi, and 58.1% (25 of 43) in Nghe An, whereas that of the middle of Vietnam was 56.7% (72 of 127) (Appendix 3). In southern Vietnam, this proportion was 80% (44 of 55) in Tien Giang, 43.5% (254 of 587) in Ho Chi Minh City, and 43.4% (53 of 122) in Can Tho.

### Predictors of a low level of vaccine knowledge

A low knowledge level was significantly associated with age, gender, region, Gapminder income levels and jobs (P < 0.001), and education levels (P = 0.035) (Table 3). There was no statistically significant association between knowledge level and household composition, chronic health conditions, experiences with COVID-19 disease, and being vaccinated (P > 0.05).

### Model for predicting a low level of vaccine knowledge

Age (adjusted odds ratio [AOR] 0.984 [95% CI 0.972–0.995], P = 0.005) and being vaccinated (0.653 [0.431–0.991], P = 0.045) were negatively associated with a low knowledge level (Table 4). Having a Gapminder income of $8 to $15 per day (1.613 [1.117–2.329], P = 0.001), $2 to $8 (2.093 [1.313–3.335], P = 0.002), and <$2 (3.341 [1.951–5.722], P < 0.001) corresponded with higher odds of having a low knowledge level compared with those whose Gapminder income was $32 or more per day. Having an education level of less than high school was positively associated with a low knowledge level compared with those whose education levels were undergraduate or above (4.214 [1.616–10.888], P = 0.003). Working in other health-related fields was positively associated with a low knowledge level compared with those who

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**Table 1**

Baseline characteristics of study participants (N = 1708)

| Characteristics                        | Summary statisticsa |
|----------------------------------------|---------------------|
| Age (y)                                | 34.3 ± 13.4 (18–80) |
| Age groups (y)                         |                     |
| ≤ 20                                   | 379 (22.2)          |
| 21–40                                  | 818 (47.9)          |
| 41–60                                  | 430 (25.2)          |
| ≥ 61                                   | 81 (4.7)            |
| Female                                 | 942 (55.2)          |
| Region of current residence            |                     |
| Northern Vietnam                       | 734 (43)            |
| Middle Vietnam                         | 127 (7.4)           |
| Southern Vietnam                       | 847 (49.6)          |
| Gapminder income levels (US$ per day)  |                     |
| < 2                                    | 348 (20.4)          |
| 2 to < 8                               | 253 (14.8)          |
| 8 to < 15                              | 583 (34.1)          |
| 15–32                                  | 343 (20.1)          |
| ≥ 32                                   | 181 (10.6)          |
| Household composition                  |                     |
| Alone                                  | 135 (7.9)           |
| With family                            | 1272 (74.5)         |
| With friends                           | 301 (17.6)          |
| Education levels                       |                     |
| < high school                          | 29 (1.7)            |
| High school                            | 140 (8.2)           |
| College                                | 140 (8.2)           |
| ≥ Undergraduate level                  | 1399 (81.9)         |
| Jobs                                   |                     |
| Health students                        | 126 (7.4)           |
| Nonhealth students                     | 378 (22.1)          |
| Working in nonhealth-related fields    | 856 (50.1)          |
| Clinical doctors and/or health lecturers| 152 (8.9)          |
| Working in other health-related fields | 196 (11.5)          |
| Chronic health conditionsb             | 222 (13)            |
| Experiences with COVID-19 diseasec     | 48 (2.8)            |
| Vaccinated against COVID-19            | 129 (7.6)           |

Abbreviation used: COVID-19, coronavirus disease 2019.

a Mean ± SD (minimum–maximum) for continuous variables and n (%) for categorical variables.

b Chronic communicable and/or noncommunicable diseases.

c Acquiring COVID-19 and/or having family members or friends/colleagues acquiring COVID-19.

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**Table 2**

COVID-19 vaccine knowledge score of study participants (N = 1708)

| Characteristics                        | Summary statisticsa |
|----------------------------------------|---------------------|
| Knowledge score (points)               | 19.2 ± 2.8 (11–28)  |
| Score groups                           |                     |
| ≤ 14                                   | 134 (7.8)           |
| 15–19                                  | 777 (45.5)          |
| 20–24                                  | 768 (45.0)          |
| ≥ 25                                   | 29 (1.7)            |
| Knowledge levels                       |                     |
| Low                                    | 911 (53.3)          |
| Acceptable                             | 797 (46.7)          |

Abbreviation used: COVID-19, coronavirus disease 2019.

a Mean ± SD (minimum–maximum) for continuous variables and n (%) for categorical variables.
Discussion

Although there are similar studies conducted in other countries,\textsuperscript{9,12-15} there was no study in Vietnam. To the best of our knowledge, this is the first study examining the level of COVID-19 vaccine knowledge in the general community in Vietnam. Our study identifies priority groups for intervention. The study also allowed us to get insight into the vaccine knowledge levels of different health professional groups who are central to vaccination education and role models, particularly those who are not clinical doctors such as nurses and pharmacists.

The study included 1708 selected individuals across Vietnam, including large cities and those with a high COVID-19 burden. The distribution of our participants by region of residence was skewed to southern Vietnam (49.6%) provided that this region accounts for 36% of the total population in Vietnam.\textsuperscript{45} This may also explain the low number of participants experiencing COVID disease in our study given that the fourth COVID-19 wave started in northern Vietnam. The number of participants getting vaccinated was low because the vaccine was exclusively available to frontline health care workers during the study period. Participants aged between 21 and 60 years and female gender were predominant in our study, which were comparable with the age and gender distributions in Vietnam.\textsuperscript{45} Given that the average income per day in Vietnam is $9.8,\textsuperscript{46} more than two-thirds of our participants (69.3%) earned less than $15 per day.

We found that more than half of participants (53.3%) had low vaccine knowledge levels. Given the mean knowledge score of 19.2 achieved by all participants, high proportions of participants having low knowledge levels, defined as their knowledge scores lower than this mean score, were documented in large cities across Vietnam. Our overall rate of low vaccine knowledge was comparable with that reported in community surveys conducted in India and Jordan.\textsuperscript{15,16} However, our proportion was higher than that reported in Bangladesh (43%, 713 of 1658) and Ethiopia (26%, 128 of 492).\textsuperscript{9,14} Although the questionnaires used in these studies were not the same, all questionnaires aim to explore essential aspects of COVID-19 vaccine knowledge including the vaccine

\textbf{Table 3}

Unadjusted predictors tested for a low level of COVID-19 vaccine knowledge among study participants (N = 1708)

\begin{tabular}{|c|c|c|c|}
\hline
Predictors & COVID-19 knowledge levels$^a$ & P value & OR (95% CI) \\
\hline
Age (y) & 32.6 ± 12.9 & 36.2 ± 13.7 & < 0.001$^b$ \\
Female & 526 (57.7) & 416 (52.2) & 0.02$^a$ \\
\hline
Region & & & \\
Northern Vietnam & 435 (47.8) & 290 (37.5) & < 0.001$^a$ \\
Middle Vietnam & 72 (7.9) & 55 (6.9) & \\
Southern Vietnam & 404 (44.3) & 443 (55.6) & \\
\hline
Gapminder income levels (US$ per day) & & & \\
< 2 & 238 (26.1) & 110 (13.8) & < 0.001$^d$ \\
2 to < 8 & 155 (17.0) & 98 (12.3) & \\
8 to < 15 & 297 (32.6) & 286 (35.9) & \\
15–32 & 154 (16.9) & 189 (23.7) & \\
> 32 & 67 (7.4) & 114 (14.3) & \\
\hline
Household composition & & & \\
Alone & 64 (7.0) & 71 (8.9) & 0.13$^c$ \\
With family & 674 (74.0) & 598 (75.0) & \\
With friends & 173 (19.0) & 128 (16.1) & \\
\hline
Education levels & & & \\
< high school & 23 (2.5) & 6 (0.8) & < 0.035$^d$ \\
High school & 70 (7.7) & 70 (8.8) & \\
College & 76 (8.3) & 64 (8.0) & \\
≥ Undergraduate level & 742 (81.5) & 657 (82.4) & \\
\hline
Jobs & & & \\
Health students & 93 (10.2) & 33 (4.1) & < 0.001$^a$ \\
Nonhealth students & 222 (24.4) & 156 (19.6) & \\
Working in nonhealth-related fields & 405 (44.4) & 451 (56.6) & \\
Clinical doctors and/or health lecturers & 68 (7.5) & 84 (10.5) & \\
Working in other health-related fields & 123 (13.5) & 73 (9.2) & \\
Chronic health conditions$^e$ & 113 (12.4) & 109 (13.7) & 0.471$^c$ \\
Experiences with COVID-19 disease$^f$ & 24 (2.6) & 24 (3.0) & 0.662$^c$ \\
Vaccinated against COVID-19 & 63 (6.9) & 66 (8.3) & 0.313$^c$ \\
\hline
\end{tabular}

Abbreviations used: COVID-19, coronavirus disease 2019; OR, odds ratio.

$^a$ Mean ± SD for continuous variables and number (%) for categorical variables.

$^b$ t test.

$^c$ Chi-square test.

$^d$ Chi-square test for trend.

$^e$ Chronic communicable and/or noncommunicable diseases.

$^f$ Acquiring COVID-19 and/or having family members or friends/colleagues acquiring COVID-19.

worked as clinical doctors or health lecturers (1.83 [1.146–2.922], P = 0.01).
were associated with low vaccine knowledge levels. Our
findings were consistent with previous studies in other
countries.14,16 It has been documented that young age, low
income, and education levels are significantly related to low
levels of health knowledge in general probably because these
groups are less likely to have heard of the health informa-
tion.1 In contrast, people with high education levels are more
knowledgeable and concerned about their health and life
events that could affect them, such as COVID-19 vaccinations,
through access to more sources of health information.1 In line
with another study, we found that being vaccinated against
COVID-19 was associated with a good vaccine knowledge
level.17 It is documented that health care workers who are
willing to be COVID-19 vaccinated serve as an important role
model function for the public.52,53 It has also been found that
the public vaccine acceptance is influenced by their peers and
social networks.54 Considering our finding of a positive asso-
ciation between being vaccinated against COVID-19 and
acceptance of vaccine knowledge levels, we believe that,
regardless of the professions, people who are vaccinated can
present role models for the community. Future research is
needed to examine how the community education programs
using these role models could effectively approach different
population groups.

In our study, participants working in health-related fields
rather than clinical doctors and health lecturers such as nurses
and pharmacists were more likely to have lower knowledge
levels compared with clinical doctors and health lecturers. To
the best of our knowledge, there is no study examining the
levels of COVID-19 vaccine knowledge among different health
professional groups in Vietnam. However, a study conducted
on Vietnamese health students found a difference in the levels
of COVID-19 vaccine acceptance by their specialist fields with
more public health students but less preventive medicine
students accepting the vaccine compared with general medi-
cine students although the differences in levels of vaccine
knowledge between these students were not examined.55
Similarly, a study in the United States found that direct med-
cal care providers had higher vaccine acceptance (49%, 595 of
1207) than other health professionals although the vaccine
knowledge levels among health professionals were not
examined.56 It should be noted that this U.S. study was con-
ducted between October 7 and November 9, 2020, and thus,
vaccine acceptance rate of this study population may have
increased owing to the recent changes in the local COVID-19
situations and community education regarding COVID-19
vaccination. Studies in Jordan and Italy found that health
care workers had higher vaccine knowledge levels than nonmedical-related professions.16,17 The finding of our study
was different than the Jordanian and Italian studies probably
because of the difference in selecting the reference group.
Based on our experience with the Vietnam context, clinical
doctors and health lecturers are updated with medical scien-
tific publications more regularly than those working in other
health and nonhealth-related fields and, thus, were selected as
our reference group. By doing this, we could be able to
compare the vaccine knowledge levels of other health profes-
sionals who were not physicians and health lecturers with
those of physicians and health lecturers. Unlike us, none of
the Jordanian and Italian studies examined the differences in
the vaccine knowledge levels between different health profes-
sional groups. Our study makes it possible to highlight the
differences in the vaccine knowledge levels between health
professional groups and, therefore, helps in developing more
targeted intervention programs. It is clear that, in addition to
vaccine knowledge, COVID-19 vaccine acceptance was influ-
enced by other factors including enabling environments (e.g.,
convenient vaccination places and easy and accessible vacci-
nation booking), social influences (e.g., salient social norms in
favor of vaccination), and motivation (e.g., increasing motiva-
tion to get vaccinated through building timely trust in

### Table 4

| Predictors                                      | P   | Adjusted OR (95% CI) |
|-------------------------------------------------|-----|---------------------|
| Age (y)                                         | 0.005 | 0.984 (0.972–0.995) |
| Female                                          | 0.518 | 0.933 (0.756–1.151) |
| Region                                          |      |                     |
| Northern Vietnam                                | 0.725 | 0.928 (0.613–1.405) |
| Southern Vietnam                                | 0.318 | 0.812 (0.54–1.221)  |
| Middle Vietnam†                                  |      |                     |
| Gapminder income levels (US per day)             |      |                     |
| < 2                                             | 0.000 | 3.341 (1.051–10.722) |
| 2 to < 8                                        | 0.002 | 2.093 (1.313–3.335) |
| 8 to < 15                                       | 0.011 | 1.613 (1.177–2.329) |
| 15–32                                           | 0.258 | 1.248 (0.85–1.833)  |
| > 32†                                           |      |                     |
| Household composition                           |      |                     |
| Alone                                           | 0.441 | 0.839 (0.538–1.31)  |
| With family                                     | 0.245 | 1.189 (0.888–1.591) |
| With friends†                                   |      |                     |
| Education levels                                |      |                     |
| < High school                                   | 0.003 | 4.214 (1.616–10.988) |
| High school                                     | 0.975 | 1.006 (0.684–1.481) |
| College                                         | 0.515 | 1.133 (0.779–1.648) |
| ≥ Undergraduate level‡                          |      |                     |
| Jobs                                            |      |                     |
| Health students                                 | 0.34  | 1.345 (0.732–2.471) |
| Nonhealth students                              | 0.09  | 0.644 (0.387–1.072) |
| Working in nonhealth-related fields             | 0.921 | 0.981 (0.671–1.434) |
| Working in other health-related fields           | 0.01  | 1.83 (1.146–2.922)  |
| Chronic health conditions‡                      | 0.27  | 1.207 (0.864–1.686) |
| Experiences with COVID-19 disease‡              | 0.641 | 1.157 (0.628–2.13)  |
| Vaccinated against COVID-19                     | 0.045 | 0.653 (0.431–0.991) |

Abbreviations used: COVID-19, coronavirus disease 2019; OR, odds ratio.
† Reference group.
‡ Chronic communicable and/or noncommunicable diseases.
§ Acquiring COVID-19 and/or having family members or friends/colleagues
acquiring COVID-19.
vaccines. However, like our study, the varied vaccine acceptance rates in different occupational roles in health care found in the U.S. study implied that the nonclinical professionals should be targeted—with educational interventions to ensure a successful COVID-19 vaccination. It should be noted that health professionals such as pharmacists, rather than physicians, have been identified as a professional figure in the health section who is qualified to improve the public vaccine acceptance in general. Indeed, a study in Vietnam also found that community pharmacists could take an important part in disseminating COVID-19 related knowledge to the public. Hence, to ensure a successful COVID-19 vaccine rollout, education programs in Vietnam should focus on improving the vaccine knowledge in those who are working in health-related fields but are not clinical doctors and health lecturers, such as nurses and pharmacists. Further studies are needed to examine the reasons for the low levels of vaccine knowledge in this group.

We found that only 41.6% of participants believed that vaccination was needed, despite the ongoing COVID-19 outbreak in Vietnam. In addition, only 20.6% of participants strongly agreed that getting vaccinated was a good way to protect oneself from COVID-19. At the time this manuscript was developed, the local government had been implemented the largest-ever vaccination campaign together with other preventive measures to control the outbreak. This implies that vaccination together with these measures may be the only way to achieve this goal as can be seen in other vaccine preventable diseases. In light of this, community education needs to emphasize the importance of the combined vaccination and nonvaccine measures in controlling the outbreak.

Our participants’ vaccine knowledge regarding vaccine efficacy and essentialness needs to be improved because 16.2% of participants strongly agreed that they were completely protected against COVID-19 after they fully completed the vaccination schedule. Only 36.4% of participants strongly disagreed that they did not need to undertake any other preventive measures after they fully completed the vaccination schedule. In addition, less than one-fifth of participants strongly agreed that vaccines developed by different manufacturers had different levels of efficacy (17.1%), and the available vaccines may not be effective on new variants compared with the original strain (12.8%). The WHO has emphasized the importance of managing the community’s expectations toward the vaccine to ensure that those who have been vaccinated do not stop practicing protective behaviors. Another issue is that only 30.3% of our participants strongly agreed that being vaccinated themselves contributed to the protection of the community against COVID-19. Vaccination not only protects oneself from COVID-19 but also helps create herd immunity to stop its spread and protect vulnerable groups who cannot get vaccinated. It is estimated that 65–70% of the population needs to be vaccinated to achieve herd immunity against COVID-19. Hence, vaccination can be conceptualized as a social responsibility, which plays an important role in educating the community regarding the essentialness of COVID-19 vaccination. Indeed, it is documented that social responsibility is positively associated with COVID-19 vaccination intention.

Considering the loss of life and economic consequences owing to COVID-19, social responsibility attached to vaccination should be emphasized by governments. Our findings highlight the need to tailor the current education program to enhance the community knowledge regarding both the essentialness and efficacy of vaccine.

Our study has some limitations. First, the government started the largest-ever COVID-19 vaccination program and enhanced the community education toward COVID-19 vaccines on the media to respond to an outbreak of COVID-19 during the study period. This may have influenced our participants’ responses to the survey. However, we believe that it is negligible given that we ended the study when the program started. Nevertheless, we have identified room for improvement of the community education programs. Second, many cities in Vietnam had been under lockdown during the study period making the online survey the most efficient method to collect data at large. Given the online survey, duplicate entries may be an issue and affect the validity of the study. However, before completing the survey, participants were asked to read the participant information sheet outlining the research purposes and what participants were required to do. Only participants who fully understood and agreed to participate in the study were enrolled in the study. We screened and reviewed potentially duplicate entries, and although we could not remove duplicates completely, these strategies should make them negligible. Third, given our study aimed to target the community at large, recruiting participants using a snowball sampling technique could cause selection bias. However, in addition to the online survey, we used a paper-based recruitment procedure in 2 largest cities in Vietnam to include those who were unable to complete the online survey such as the older and those who did not have an Internet-enabled device or Internet connection. The use of a combination of 2 different, complementary data collection methods helped include a diverse study population in our study, which increased the generalizability of the study’s results. Finally, responses to our vaccine knowledge questions can be influenced by study participants’ antivaccination attitudes, which were not assessed in this study. Consequently, our study may underestimate the true vaccine knowledge level among participants who want to avoid all vaccination or COVID-19 vaccination (antivaxxers).

Conclusion

People who are at young age, have low income or education levels, and work in nonclinical and nonhealth education fields have low COVID-19 vaccine knowledge levels. To ensure a successful COVID-19 vaccine rollout and sustainable control and prevention of COVID-19, it is crucial to improve the knowledge about vaccine essentialness and efficacy in the community. Community education programs may be beneficial from using those who have been vaccinated as role models.

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Appendix

Appendix 1

**Questionnaire**

**I. General information:**

1. Year of birth (please specify): ..........
2. Gender: □ Male □ Female
3. Residential address (please only specify the city name): .............
4. Region of residence: □ Northern Vietnam □ Middle Vietnam □ Southern Vietnam
5. Gapminder income levels (US$ per day)*: □ <2 □ 2 - <8 □ 8 - <15 □ 15 - <32 □ ≥32
6. Household composition: □ Living alone □ Living with family □ Living with friends
7. Education levels: □ Less than high school □ High school □ College □ Undergraduate level or above
8. Majors: □ Health students □ Non-health students □ Working in non-health related fields □ Being clinical doctor and/or health lecturer □ Working in other health related fields
9. Health conditions: □ Do not have chronic conditions □ Having chronic, noncommunicable diseases □ Having chronic, communicable diseases
10. COVID-19 disease experience: □ Having COVID-19 or acquired COVID-19 previously □ Having a family member who has COVID-19 or acquired COVID-19 previously □ Having a friend/colleague who has COVID-19 or acquired COVID-19 previously □ Never acquire COVID-19, or know anyone who has COVID-19 or acquired COVID-19 previously

*To assist study participants in completing the questionnaire easily, the currency was converted to VND and the unit was VND per month in the Vietnamese version of the questionnaire.

**II. COVID-19 vaccine knowledge:**

1. I am completely protected against COVID-19 after I fully complete the COVID-19 vaccination schedule

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|
|                |       |                    |          |                   |

2. I do not need to undertake any other COVID-19 preventive measures after I fully complete the COVID-19 vaccination schedule

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|
|                |       |                    |          |                   |

3. Being vaccinated for COVID-19 myself contributes to the protection of the community against COVID-19

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|
|                |       |                    |          |                   |
4. Getting vaccinated for COVID-19 is a good way to protect myself from COVID-19

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|

5. I do not need to get vaccinated for COVID-19 because the COVID-19 outbreak is controlled very well in Vietnam.

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|

6. COVID-19 vaccines developed by different manufacturers have different levels of efficacy

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|

7. The available COVID-19 vaccines may be less effective on new variants compared with the original strain

| Strongly agree | Agree | Neutral/no opinion | Disagree | Strongly disagree |
|----------------|-------|--------------------|----------|-------------------|
Appendix 2

Details of participants’ responses to COVID-19 vaccine knowledge questions

| Questions response (assigned score) | Summary statistics n (%) |
|-------------------------------------|---------------------------|
| **Q1. I am completely protected against COVID-19 after I fully complete the COVID-19 vaccination schedule** |                           |
| Strongly agree (0)                  | 277 (16.2)                |
| Agree (1)                           | 745 (43.6)                |
| Neutral/no opinion (2)              | 389 (22.8)                |
| Disagree (3)                        | 259 (15.2)                |
| Strongly disagree (4)               | 38 (2.2)                  |
| **Q2. I do not need to undertake any other COVID-19 preventive measures after I fully complete the COVID-19 vaccination schedule** |                           |
| Strongly agree (0)                  | 25 (1.5)                  |
| Agree (1)                           | 55 (3.2)                  |
| Neutral/no opinion (2)              | 199 (11.6)                |
| Disagree (3)                        | 808 (47.3)                |
| Strongly disagree (4)               | 621 (36.4)                |
| **Q3. Being vaccinated for COVID-19 myself contributes to the protection of the community against COVID-19** |                           |
| Strongly agree (4)                  | 518 (30.3)                |
| Agree (3)                           | 919 (53.8)                |
| Neutral/no opinion (2)              | 228 (13.4)                |
| Disagree (1)                        | 31 (1.8)                  |
| Strongly disagree (0)               | 12 (0.7)                  |
| **Q4. Getting vaccinated for COVID-19 is a good way to protect myself from COVID-19** |                           |
| Strongly agree (4)                  | 352 (20.6)                |
| Agree (3)                           | 885 (51.8)                |
| Neutral/no opinion (2)              | 323 (18.9)                |
| Disagree (1)                        | 133 (7.8)                 |
| Strongly disagree (0)               | 15 (0.9)                  |
| **Q5. I do not need to get vaccinated for COVID-19 because the COVID-19 outbreak is controlled very well in Vietnam** |                           |
| Strongly agree (0)                  | 17 (1)                    |
| Agree (1)                           | 28 (1.6)                  |
| Neutral/no opinion (2)              | 208 (12.2)                |
| Disagree (3)                        | 745 (43.6)                |
| Strongly disagree (4)               | 710 (41.6)                |
| **Q6. Vaccines developed by different manufacturers have different levels of efficacy** |                           |
| Strongly agree (4)                  | 292 (17.1)                |
| Agree (3)                           | 819 (48)                  |
| Neutral/no opinion (2)              | 463 (27.1)                |
| Disagree (1)                        | 113 (6.6)                 |
| Strongly disagree (0)               | 21 (1.2)                  |
| **Q7. The available COVID-19 vaccines may be less effective on new variants compared with the original strain** |                           |
| Strongly agree (4)                  | 219 (12.8)                |
| Agree (3)                           | 877 (51.3)                |
| Neutral/no opinion (2)              | 552 (32.3)                |
| Disagree (1)                        | 54 (3.2)                  |
| Strongly disagree (0)               | 6 (0.4)                   |
Appendix 3: Distribution of levels of COVID-19 vaccine knowledge in Vietnam.