## RESEARCH ARTICLE

# COVID-19 vaccination knowledge, attitudes, risk perception, and intention among health workers in a district in Manila, Philippines

**Crystal Amiel M. Estrada**[1*], **Maylin C. Palatino**[2,3], **Marian Fe Theresa C. Lomboy**[1], **Evalyn A. Roxas**[4], **Buenalyn Teresita M. Ramos-Mortel**[5], **Ernesto R. Gregorio, Jr.**[5]

*Corresponding author's email address: cmestrada@up.edu.ph

[1]*Department of Environmental and Occupational Health, College of Public Health, University of the Philippines Manila, Manila, Philippines*
[2]*Philippine Health Initiative for Research, Service, and Training, Brown University Global Health Initiative, Providence, Rhode Island, USA*
[3]*Department of Biostatistics and Epidemiology, College of Public Health, University of the Philippines Manila, Manila, Philippines*
[4]*Department of Medical Microbiology, College of Public Health, University of the Philippines Manila, Manila, Philippines*
[5]*Department of Health Promotion and Education, College of Public Health, University of the Philippines Manila, Manila, Philippines*

**ABSTRACT**

**Background:** Vaccination is an effective public health measure. Health workers, who are at risk of acquiring infectious diseases due to their occupation, are important targets of vaccination. However, previous studies have shown varying rates of vaccine uptake among health workers.

**Objective:** This study aimed to determine the knowledge, attitudes, risk perceptions, and intention towards COVID-19 and vaccination of Filipino health workers in the city of Manila, Philippines.

**Methodology:** The study employed a sequential mixed methods design. A self-administered questionnaire was used to collect data on the study variables. Descriptive statistics was used to analyze the level of COVID-related knowledge, attitude, risk perception, and intention to receive the COVID-19 vaccine. Logistic regression was performed to identify the factors that were associated with intention.

**Results:** Majority (89.4%) had a good knowledge of COVID-19 but had little to moderate knowledge of COVID-19 vaccines. Around half reported feeling unsure about the safety and efficacy of the vaccines while the remaining half expressed intent to get the vaccine. Logistic regression analysis showed that the odds of intention to get vaccinated were higher among those with positive perceived self-efficacy, behavioral intention, external cues to action, perceived vaccine efficacy, and good knowledge on COVID-19 infection prevention.

**Conclusion:** Health workers play a crucial role in the promotion of public health measures such as vaccination to control the spread of COVID-19. The study confirms the need for strengthening education and communication strategies focusing on the safety and efficacy of COVID-19 vaccines to prevent the spread of false information and promote vaccine uptake among health workers.

**Keywords:** *COVID-19, knowledge, risk perception, vaccine acceptance, health workers, Philippines*

## Introduction

The coronavirus disease (COVID-19) pandemic is the most pressing challenge to public health in recent years. Its rapid global spread has overwhelmed the health systems of many countries around the world and has led to unprecedented economic and social disruption. As of October 05, 2021, there were 235,175,106 confirmed cases of COVID-19 worldwide, with 4,806,841 recorded deaths [1]. In the Philippines, the Department of Health has recorded a total of 2,613,070 cases and 38,828 deaths due to COVID-19 during the same period [2].

Vaccination is an important and effective public health measure. It has significantly contributed to the reduction of morbidity and mortality due to life-threatening infectious diseases such as diphtheria, measles, tetanus, and influenza [3]. Vaccination is also crucial in halting the COVID-19 pandemic, and to date, several safe and effective vaccines have already been approved and deployed for emergency use.

Health workers, who are at risk of acquiring vaccine-preventable diseases due to their occupation, are important targets of vaccination. They play a crucial role in ensuring

that communities, workplaces, and health systems can respond especially in times of emergencies due to natural or man-made hazards [4]. Vaccination protects health workers against the biological hazards that are present in their respective workplaces and can also prevent disease transmission to patients [5]. Vaccination also reduces absenteeism among health workers [6,7]. In addition, health workers are considered a reliable source of vaccination information by patients [8], and their attitudes or behaviors towards vaccination can help shape the public's view and uptake [9]. However, previous studies have shown that vaccine uptake even among health workers vary and tend to be low [10-14], with misconceptions and lack of knowledge cited as some of the major reasons affecting uptake [13,14]. Safety and efficacy concerns, perceived susceptibility, severity of infection, benefits, and costs are also found to be drivers of vaccine uptake among health workers [14,15]. Thus, this study aimed to describe the knowledge, attitudes, risk perceptions, and intention towards COVID-19 and vaccination of Filipino frontline workers in health facilities in a selected district in the city of Manila, Philippines. The information on their knowledge, attitudes, risk perceptions, and intention towards COVID-19 and vaccination will aid in the enhancement of a risk communication intervention that will target the health workers' perceptions and behavioral intention towards COVID-19 vaccination.

## Methodology

### Study Design

The study employed a sequential mixed methods design. Key informant interviews and focus group discussions were conducted to pretest the tool developed for the study. Meanwhile, an analytical cross-sectional design was employed to measure the health workers' knowledge, attitudes, risk perceptions, and intention towards COVID-19 and vaccination, as well as to identify factors associated with intention to receive the vaccine.

### Study Setting and Participants

Manila, the capital city of the Philippines, was selected due to its high COVID-19 transmission rates and the local government unit's strong political commitment in securing COVID-19 vaccines for its constituents as soon as these become available. Frontline workers, specifically health and allied health professionals (doctors, nurses, dentists, medical technologists, dental aides, barangay health workers, midwives, nursing attendants, sanitation officers,

laboratory aides) and support staff (administrative officers, security personnel) who are at least 18 years old and have been residing in the city for the past 12 months were asked to participate in the study.

Total enumeration of health workers of a selected district in the city of Manila was conducted. Permission to conduct the study was granted by the local government through the Manila Health Department. The study was reviewed and approved by the University of the Philippines Manila Research Ethics Board (UPMREB 2021-016-01).

### Data Collection and Analysis

Data collection was conducted in April 2021. A self-administered questionnaire was used to collect data. The participants were guided by trained data collectors while filling out the survey. The questionnaire was developed based on previous studies conducted in China [16], Malaysia [17], the United States [18], and the Philippines [19]. Forward and back translation of the tool was also conducted. Pretesting, which focused on the duration of answering the survey, identification of responses to open-ended questions, clarity, and cultural sensitivity of the instructions, questions, and responses, was conducted with 10 health workers in another city with a similar profile as that of the intended target audience. The tool was reviewed and revised according to the results of the pretest by the investigators who were experts on biostatistics, infectious diseases, public health research, and health promotion and risk communication. The final tool was composed of 56 items which were divided into five sections: 1) sociodemographic characteristics; 2) experience of COVID-19; 3) knowledge of COVID-19 and COVID-19 vaccine; 4) attitudes towards COVID-19 vaccine; and 5) perceptions and intentions towards COVID-19 vaccine and vaccination. Intention to receive the COVID-19 vaccination was used as a proxy indicator for vaccine uptake since the study was conducted prior to the roll-out of the Philippine COVID-19 vaccination program.

R software was used to conduct all the data analyses in the study. To describe the health workers' knowledge, attitudes, risk perception, and intention to receive the COVID-19 vaccine, frequencies and proportions were computed. Meanwhile, simple and multiple logistic regression analyses were performed to identify the factors that were associated with intention. Starting with the full model, which contained all the independent variables, the backward elimination selection method was used to remove

the variables with p-values higher than 0.100 starting from the highest p-value. Only the variables with p-values less than 0.100 were included in the final model. The unadjusted and adjusted odds ratios with their corresponding 90% confidence intervals were recorded.

## Results

### Characteristics of the Participating Health Workers

The study had a total of 188 respondents from 12 health facilities, with an average age of 46.2 years. The majority of the respondents were females (83.0%), Roman Catholics (89.9%), and had received at least college-level education (70.2%). More than half were married (61.2%) and had reported a monthly income higher than 15,000 pesos (51.6%). Barangay health workers (BHWs) accounted for almost half (43.1%) of the respondents, followed by nurses (14.9%) and midwives (9.6%) (Table 1).

### Experience of COVID-19 Infection

Most of the respondents had not been exposed to a person with COVID-19 in the past month prior to data collection (75.5%). Of the four respondents (2.1%) who reported experiencing signs and symptoms similar to COVID-19, two had cough and muscle aches while only one had a cold and headache.

A small proportion (8.0%) of the respondents perceived COVID-19 as very serious while 21.8% felt that it was not severe at all. A little more than a third (36.2%) were unsure about the severity of COVID-19. Meanwhile, 13.8% of the participants felt that there was no chance that they would get the infection while 21.8% reported a low chance. Only 11.2% felt that there is a high chance for them to get the infection. About a third (34%) of the respondents also felt unsure of their susceptibility to the infection.

### Knowledge about COVID-19

The majority of the respondents (89.4%; 90% confidence interval: 85.7 – 93.0%) were able to answer five or six of the knowledge questions, which indicated good knowledge about COVID-19 infection. Only three respondents had zero to two correct answers (1.5%).

Almost all respondents were aware that COVID-19 is transmitted through the respiratory droplets of infected individuals (97.3%) and that the main clinical symptoms of

the disease are fever, fatigue, dry cough, and body aches (93.1%). The majority also correctly identified prevention and control measures such as avoidance of crowded places (91.0%), and isolation and treatment of people with COVID-19 (97.3%). However, a little more than half answered that eating or touching wild animals would lead to COVID-19 infection (Table 2).

News media (76%), health workers (74%), and official government websites (68%) were the top three sources of information about COVID-19 that were reported by the respondents. A little more than half (51%) of the

**Table 1.** *Characteristics of the participating health workers, city of Manila, Philippines, April 2021 (n = 188)*

| Characteristic | Freq. | Percent |
|---|---|---|
| **Sex** | | |
| Male | 156 | 83.0 |
| Female | 32 | 17.0 |
| **Marital status** | | |
| Married | 115 | 61.2 |
| Single | 31 | 16.5 |
| Living with a partner | 18 | 9.6 |
| Separated/divorced | 12 | 6.4 |
| Widowed | 9 | 4.8 |
| Did not want to declare | 3 | 1.6 |
| **Religion** | | |
| Roman Catholic | 169 | 89.9 |
| Other | 19 | 10.1 |
| **Educational attainment** | | |
| At least college level | 132 | 70.2 |
| High school level/Vocational | 56 | 29.8 |
| Elementary level | 0 | 0.0 |
| **Monthly family income** | | |
| <5,000 | 8 | 4.3 |
| 5,001 - 15,000 | 82 | 43.6 |
| >15,000 | 97 | 51.6 |
| No response | 1 | 0.5 |
| **Health worker classification** | | |
| Barangay Health Worker (BHW) | 81 | 43.1 |
| Nurse | 28 | 14.9 |
| Midwife | 18 | 9.6 |
| Doctor | 10 | 5.3 |
| Dentist | 10 | 5.3 |
| Support staff | 10 | 5.3 |
| Not stated | 10 | 5.3 |
| Sanitation Officer | 9 | 4.8 |
| Nursing attendant | 5 | 2.7 |
| Dental aide | 2 | 1.1 |
| Laboratory aide | 2 | 1.1 |
| Medical technologist | 2 | 1.1 |
| Nurse supervisor | 1 | 0.5 |

**Table 2.** *The proportion of participating health workers with correct answers on knowledge questions, city of Manila Philippines, April 2021 (n = 188)*

| Knowledge item | Freq. | Percent |
|---|---|---|
| Isolation and treatment of people with COVID-19 virus infection are effective ways to reduce its spread. | 183 | 97.3 |
| The COVID-19 virus spreads via respiratory droplets of infected individuals. | 183 | 97.3 |
| There is currently no effective cure for COVID-19 | 178 | 94.7 |
| The main clinical symptoms of COVID-19 are fever, fatigue, dry cough, and body aches | 175 | 93.1 |
| COVID-19 infection can be prevented by avoiding crowded places and avoiding public transportation. | 171 | 91.0 |
| Eating or touching wild animals would NOT necessarily result in the infection by COVID-19 virus. | 91 | 48.4 |

*proportion of good knowledge = 89.4% (95% Confidence interval: 85.0% − 93.8%)

**Table 3.** *Distribution of the participating health workers according to perception on COVID-19 vaccine, city of Manila, Philippines, April 2021 (n = 188)*

| Item | Freq. | Percent |
|---|---|---|
| **Perceived level of knowledge on COVID-19 vaccine** | | |
| Nothing at all | 11 | 5.9 |
| A little | 91 | 48.4 |
| A moderate amount | 81 | 43.1 |
| A lot | 5 | 2.7 |
| **Description of information seen or heard about COVID-19 vaccines** | | |
| Same information across different sources | 53 | 28.2 |
| Conflicting information across different sources | 127 | 67.6 |
| Other | 5 | 2.7 |
| No response | 3 | 1.6 |
| **Amount of info about COVID-19 vaccines that seemed fake or made up** | | |
| Nothing at all | 21 | 11.2 |
| A little | 106 | 56.4 |
| A moderate amount | 55 | 29.3 |
| A lot | 6 | 3.2 |
| **Information believed to be fake or made up** | | |
| The effect depends on the body of each person | 73 | 38.8 |
| It can kill a person | 58 | 30.9 |
| It is not effective | 51 | 27.1 |
| It brings other diseases | 67 | 35.6 |
| It is safe and has no adverse effects | 25 | 13.3 |
| It causes allergic reactions | 26 | 13.8 |

respondents cited social media as a source of COVID-19 related information. Only about one in five (23%) identified scientists and researchers as a source of their information.

*Knowledge about COVID-19 Vaccine*

Of the 188 participants, 48.4% and 43.1% reported having a little and a moderate level of knowledge on the COVID-19 vaccine, respectively. About two-thirds (67.6%) reported that they saw or heard conflicting information related to the COVID-19 vaccine from different sources. About half (56.4%) believed that a small amount of the information that they

have seen or heard about the COVID-19 vaccines seemed fake or made up. Specifically, that the effect depends on the body of each person (38.8%), it brings other diseases (35.6%), and it can kill a person (30.9%) were the most common information that seemed fake to the respondents (Table 3).

On the trustworthiness of available data related to the COVID-19 vaccines, news media (67%) was identified as the most trustworthy source, followed by official government websites (26%) and fellow health workers (24%). Only a small proportion of the respondents reported that scientists or researchers (6%) and LGU leaders (8%) were trustworthy sources.

**Table 4.** *The attitude of the participating health workers on getting a COVID-19 vaccine, city of Manila, Philippines, April 2021 (n = 188)*

| Item | Disagree | | Unsure | | Agree | |
|------|------|---------|------|---------|------|---------|
| | Freq. | Percent | Freq. | Percent | Freq. | Percent |
| I trust the information I receive about COVID-19 vaccines. | 81 | 43.1 | 87 | 46.3 | 20 | 10.6 |
| I am concerned that I might have a serious side effect from a COVID-19 vaccine. | 48 | 25.5 | 84 | 44.7 | 56 | 29.8 |
| I am concerned that the vaccine might not be safe. | 68 | 36.1 | 90 | 47.9 | 30 | 16.0 |
| I am concerned that the vaccine might not protect me from COVID-19 cough, and body aches. | 65 | 34.6 | 94 | 50.0 | 29 | 15.4 |
| I am hesitant about the COVID-19 vaccine. | 56 | 29.8 | 97 | 51.6 | 35 | 18.6 |
| Getting the COVID-19 vaccine is against the teachings of my religion. | 129 | 68.6 | 49 | 26.1 | 10 | 5.3 |
| If my family/friend would recommend that I get the vaccine, I would follow their advice. | 79 | 42.0 | 77 | 41.0 | 32 | 17.0 |
| I am confident that I will get the vaccine even if I have to go to a HC/hospital. | 33 | 17.6 | 79 | 42.0 | 76 | 40.4 |
| I am willing to receive the vaccine when it becomes available. | 27 | 14.4 | 95 | 50.5 | 66 | 35.1 |
| I am willing to receive the vaccine if it is free and covered by health insurance. | 27 | 14.3 | 84 | 44.7 | 77 | 41.0 |
| I am willing to volunteer for a clinical trial for a COVID-19 vaccine. | 66 | 35.1 | 78 | 41.5 | 44 | 23.4 |
| If my doctor/health provider would recommend that I get the vaccine, I would follow the advice. | 17 | 9.0 | 74 | 39.4 | 97 | 51.6 |
| If a celebrity/personality that I admire will get the vaccine, I will also get vaccinated. | 87 | 46.3 | 61 | 32.5 | 40 | 21.2 |
| I will get vaccinated against COVID-19 if government officials get vaccinated first. | 48 | 25.5 | 48 | 25.5 | 92 | 48.9 |
| I am likely to get vaccinated against COVID-19 if I have sufficient scientific knowledge about the safety of the vaccine. | 25 | 13.3 | 44 | 23.4 | 119 | 63.3 |
| Getting the vaccine will protect me from getting infected. | 42 | 22.3 | 114 | 60.7 | 32 | 17.0 |
| Getting the vaccine will benefit the health of my family and friends. | 22 | 11.7 | 79 | 42.0 | 87 | 46.3 |
| Other people being vaccinated against COVID-19 will be helpful in controlling the pandemic. | 14 | 7.5 | 63 | 33.5 | 111 | 59.0 |
| The side effects of the vaccine are likely to be worse than COVID-19 itself. | 63 | 33.5 | 112 | 59.6 | 13 | 6.8 |
| If the vaccine will not be free and not covered by my health insurance, I will not get myself vaccinated. | 62 | 33.0 | 78 | 41.5 | 48 | 25.5 |
| If my religious leader/spiritual adviser advises me against getting the vaccine, I will follow his advice. | 104 | 55.3 | 72 | 38.3 | 12 | 6.4 |
| If I do decide to get the COVID-19 vaccine, it would be difficult to find a clinic/health provider that could give me the vaccine. | 85 | 45.2 | 85 | 45.2 | 18 | 9.6 |

*Attitudes towards COVID-19 Vaccine*

Only one in ten respondents (10.6%) trust the information that they receive about COVID-19 vaccines (Table 4). Around half of the participants were unsure about the safety (47.9%) and efficacy (50.0%) of COVID-19 vaccines. Of the 188 respondents, 56 (29.8%) expressed concerns of having a serious side effect from a COVID-19 vaccine while 112 (59.6%) were unsure if the side effects of the vaccine are likely to be worse than COVID-19 itself. However, it is worthy to note that only 18.6% expressed hesitancy towards the vaccine.

The majority of the respondents (68.6%) reported that the vaccine is not against the teachings of their religion. About a third (35%) were willing to receive the vaccine when it becomes available while 41% were willing to receive it if it is free and covered by health insurance. Of the 188 participants, 119 (63.3%) felt that they were likely to get vaccinated if they have sufficient scientific knowledge about the safety of the vaccine. Only 23.4% were willing to participate in a clinical trial.

A little more than half (51.6%) of the respondents reported that they will follow their doctor or health provider's advice to get the vaccine. On the other hand, 21.2% will get it if a celebrity or public personality that they admire will also get it while 48.9% reported that they wanted to see government officials get vaccinated first. In addition, 42% responded that they would not follow their family or friends' advice to get the vaccine while about the same proportion of respondents were also unsure (41%).

A little more than half (60.7%) were unsure if the vaccine could protect them against infection. Nevertheless, 46.3% and 59.0% believed that getting inoculated will benefit the health of their family and friends and that other people being vaccinated against COVID-19 will help control the pandemic, respectively.

When asked who they want to see vaccinated first before they get themselves vaccinated, national government officials (68%) was the most frequent answer, followed by local government unit (LGU) officials (51%) and fellow health workers (43%).

*Intention towards COVID-19 Vaccination*

Of the 188 participants, none had been vaccinated yet at the time of data collection. However, 50% expressed their intent to receive the COVID-19 vaccine (90% confidence interval: 44.0% – 56.0%). The most common reasons for getting immunized were to protect oneself, their family orcommunity (39.9%), and to stop the spread of COVID-19 (3.19%). Other cited reasons were to achieve herd immunity (0.53%), because it is mandatory (0.53%), to return the situation to normal (0.53%), and to no longer fear COVID-19 (0.53%). When asked when they plan to get vaccinated, the responses were as soon as possible (14.36%), when their preferred brand is available (12.23%), and when it becomes available (9.04%). Meanwhile, fear of the vaccine and its side effects (13.98%), existing health concerns or comorbidities (11.29%), still being undecided (8.06%), insufficient information on the vaccine and its efficacy (4.30%), and plans of getting pregnant/currently pregnant (1.61%) were reported as reasons for not getting vaccinated.

*Factors Associated with the Intention to Get Vaccinated*

Logistic regression analysis of the factors associated with intention to get the COVID-19 showed that without controlling for any variable, males were more likely to have the intention to get the vaccines. Respondents who had a monthly income of 5,001 to 15,000 pesos also were five times more likely to get the vaccine compared to those who had a monthly income lower than 5,000 pesos (Table 5).

Respondents who had positive social norms (religious teachings, family recommendation), perceived risk (perceived side effects), perceived barriers (vaccine cost), perceived self-efficacy (getting the vaccine even if there is a need to go to a health center or hospital), behavioral intention, external cues to action (health provider's recommendation to get the vaccine), benefit, and efficacy had higher odds of having the intention to get vaccinated as compared to those with negative or unsure attitudes when no other variables were controlled (Table 5).

The final multiple logistic regression model showed that perceived self-efficacy, behavioral intention, external cues to action, perceived vaccine efficacy, and knowledge on prevention of COVID-19 infection were statistically associated with the intention to get vaccinated. Controlling for the effect of the other statistically significant variables, the odds of having the intention to get the COVID-19 vaccine was 4.58, 4.18, 2.19, and 2.15 times higher for those who had positive perceived self-efficacy, behavioral intention, external cues to action, and perceived vaccine efficacy, respectively, as compared to those with negative or unsure attitudes. Moreover, those who had good knowledge of the

**Table 5.** *Results of logistic regression on the factors associated with intention to get the COVID-19 vaccine among health workers, city of Manila, Philippines, April 2021*

| Variable (Reference group) | Simple logistic reg. analyses | | | | Multiple logistic reg. analysis | | | |
|---|---|---|---|---|---|---|---|---|
| | Crude OR | 90% CI | | P-value | Adj. OR | 90% CI | | P-value |
| **Sex (Female)** | | | | | | | | |
| Male | 2.51 | 1.27 | 4.95 | 0.0264 | | | | |
| **Age** | **0.99** | **0.96** | **1.02** | **0.5244** | | | | |
| **Marital status (Single)** | | | | | | | | |
| Married/Living with a partner | 0.61 | 0.31 | 1.20 | 0.2299 | | | | |
| Separated/divorced/Widowed | 1.06 | 0.68 | 1.82 | 0.8262 | | | | |
| **Religion (Other)** | | | | | | | | |
| Roman Catholic | 0.90 | 0.39 | 2.08 | 0.8356 | | | | |
| **Educational attainment (At least HS level)** | | | | | | | | |
| At least college level | 1.54 | 1.05 | 2.25 | 0.0633 | | | | |
| **Monthly family income (<5,000)** | | | | | | | | |
| 5,001 - 15,000 | 4.59 | 1.30 | 16.22 | 0.0477 | | | | |
| >15,000 | 0.51 | 0.23 | 1.13 | 0.1643 | | | | |
| **Knowledge on transmission (poor)** | | | | | | | | |
| Good | 1.48 | 0.91 | 2.42 | 0.1827 | | | | |
| **Knowledge on symptoms (poor)** | | | | | | | | |
| Good | 1.47 | 0.54 | 3.96 | 0.5267 | | | | |
| **Knowledge on prevention (poor)** | | | | | | | | |
| Good | 2.67 | 1.08 | 6.64 | 0.0761 | 3.43 | 1.07 | 10.95 | 0.0821 |
| **Knowledge on treatment (poor)** | | | | | | | | |
| Good | 1.02 | 0.35 | 2.97 | 0.9718 | | | | |
| **Perceived risk (negative/unsure)** | | | | | | | | |
| Positive | 3.64 | 2.10 | 6.31 | 0.0001 | | | | |
| **Perceived severity (not or a little serious)** | | | | | | | | |
| Don't know/Unsure | 0.78 | 0.50 | 1.21 | 0.3560 | | | | |
| Moderately or very serious | 0.72 | 0.47 | 1.10 | 0.2038 | | | | |
| **Perceived susceptibility (no or low chance)** | | | | | | | | |
| Don't know/Unsure | 1.74 | 1.13 | 2.67 | 0.0344 | | | | |
| Moderately or very serious | 1.29 | 0.84 | 1.97 | 0.3244 | | | | |
| **Social norms (negative/unsure)** | | | | | | | | |
| Positive | 3.85 | 2.1 | 7.04 | 0.0003 | | | | |
| **Perceived self-efficacy (negative/unsure)** | | | | | | | | |
| Positive | 17.88 | 9.23 | 34.62 | <0.0001 | 4.58 | 1.94 | 10.79 | 0.0036 |
| **Behavioral intention (negative/unsure)** | | | | | | | | |
| Positive | 18.16 | 8.73 | 37.79 | <0.0001 | 4.18 | 1.60 | 10.94 | 0.0146 |
| **External cues to action (negative/unsure)** | | | | | | | | |
| Positive | 5.70 | 3.26 | 9.98 | <0.0001 | 2.19 | 1.11 | 4.33 | 0.0581 |
| **Perceived benefit (negative/unsure)** | | | | | | | | |
| Positive | 7.23 | 4.19 | 12.46 | <0.0001 | | | | |
| **Perceived efficacy (negative/unsure)** | | | | | | | | |
| Positive | 6.58 | 3.66 | 11.85 | <0.0001 | 2.15 | 1.06 | 4.37 | 0.0776 |
| **Perceived barriers (negative/unsure)** | | | | | | | | |
| Positive | 3.46 | 2.07 | 5.78 | 0.0001 | | | | |

COVID-19 infection prevention had 3.43 times the odds of having the intention to get vaccinated compared to those with poor knowledge (Table 5).

## Discussion

The study sought to determine the knowledge, attitudes, risk perceptions, and intention of health workers in a selected district of Manila towards COVID-19 vaccination. Most of the respondents had good knowledge of COVID-19 but had little to moderate level of knowledge about the COVID-19 vaccine. Almost two-thirds reported hearing or seeing conflicting information about the vaccine while about half felt that the information that they have seen or heard seemed fake or made up. News media, fellow health workers, and official government websites were the most common and trustworthy sources of the respondents' COVID-related information. Less than a third perceived that they have moderate to high susceptibility of getting infected while around 20% felt that COVID-19 infection is severe. Around 50% of the respondents felt unsure about the safety and efficacy of the COVID-19 vaccines, but 63% reported that they are likely to get vaccinated against COVID-19 if they have sufficient scientific knowledge. Of the 188 participants, 50% expressed intent to receive the COVID-19 vaccine, with protection for oneself, their family, and community, and to stop the spread of COVID-19 as the most common reasons for getting immunized. Logistic regression analysis showed that when controlling for the effect of other statistically significant variables, the odds of having the intention to get vaccinated were higher for those with perceived self-efficacy, behavioral intention, external cues to action, and perceived vaccine efficacy, respectively, as compared to those with negative or unsure attitudes. Those who had good knowledge of COVID-19 infection prevention also had higher odds of having the intention to get vaccinated compared to those with poor knowledge.

The good knowledge of COVID-19 and its prevention demonstrated by the participants is similar to the findings of a study conducted among Vietnamese health workers [20]. However, the findings of the study also indicate that mistrust and lack of information on the COVID-19 vaccines persist even among health workers. Loomba et al. has shown that COVID-19 vaccine acceptance is reduced to up to around 6% following exposure to misinformation [21]. A large proportion of the respondents reported either receiving or hearing conflicting or made-up information which may have also led to the respondents feeling unsure about the safety and efficacy of the vaccines. However, as expressed by a significant number of the respondents, their likelihood of getting vaccinated and recommending COVID-19 vaccines to the public may increase should they be provided with the vaccines' safety and efficacy characteristics and by the higher odds of getting immunized among those with positive attitudes towards perceived vaccine efficacy. As seen in the findings of the present and previous studies [20,23], health workers play a role in vaccine uptake among the general population [10,22] who value and trust their own healthcare provider's recommendations, which may positively influence their intent to get vaccinated. Thus, intervention strategies targeting the health workers' knowledge on the vaccines' safety and efficacy profiles can influence their vaccine uptake and consequently, the public.

The study also highlights the importance of traditional broadcast media and the government in providing reliable COVID-19 and vaccine-related information. Most of the respondents consume information from these sources and trust the accuracy and veracity of the information being provided by these sources. Studies among Vietnamese and Ghanaian health workers have also reported news media and government websites as common sources of information [15,20]. The underutilization of scientists and researchers as trustworthy sources of COVID-19-related information also needs to be emphasized. Thus, it is imperative that news media and the government collaborate with other relevant stakeholders such as the scientific community to provide correct, reliable, and easy to understand information, prevent the spread of false information, and promote responsible reporting of COVID-19 and vaccine-related news among health workers and the public.

A small proportion of the respondents perceived that they are susceptible to the COVID-19 infection. Similarly, a small proportion felt that the infection is severe. This may be explained by the findings that only a few of the respondents had experienced the symptoms and had been exposed to persons with COVID-19. In a study among Ghanaian health workers, those who do not know if their relatives were diagnosed with COVID-19 were less likely to accept the vaccine [15]. Furthermore, the good knowledge on COVID-19 exhibited by a majority of the participants may also partly explain their risk perceptions since they are highly knowledgeable about the disease transmission and how they can protect themselves. Nevertheless, it is important to emphasize the importance of their role, especially those who are working in the communities, in practicing and promoting public health measures against COVID-19.

Around half of the participants expressed intent on getting vaccinated which was higher than that of Americans and

Ghanaians [15,23] but lower than Vietnamese, Italian, Sudanese, and Kuwaiti health workers [20,24-26]. Furthermore, only a small proportion of the respondents expressed hesitancy towards the vaccine which is contrary to the findings of another study on American [27] and Sudanese [26] health workers, including a review of published studies from 35 countries [28]. This relatively high proportion of intended uptake and low hesitancy is an opportunity to maximize vaccination among health workers which can have positive consequences. Higher vaccination rates among this group can possibly translate to reduced staff absenteeism and patient mortality which has been observed previously with influenza vaccination [5-7]. Furthermore, it can potentially influence their favorable recommendation of the vaccine to their family and friends, as observed in previous studies as well [23,29,30].

In contrast with other studies where perceived severity and susceptibility and demographic characteristics such as age, sex, and level of education were found to be associated with the intention to receive the vaccine [18,25,28,31], no such statistical associations were observed in this study which may partly be due to its small sample size. However, the observed association between cues to action and the intention to receive the vaccine has been previously documented among Vietnamese health workers [20]. The observed association between intention and self-efficacy is also corroborated by a study conducted among Chinese healthcare workers [32].

The findings of the current study also conform to the body of existing literature describing the influence of perceived vaccine efficacy on the intention to receive vaccination. The association between vaccine efficacy and intention, which was demonstrated in this study, has also been documented in previous studies, such as in Indonesia, where being a healthcare worker was found to be associated with higher acceptance of hypothetical COVID-19 vaccines with 50% and 95% vaccine efficacy [33], and in Colombia, where more physicians reported acceptance as the vaccine's reported efficacy increased [34]. The same relationship has also been observed even in the general population, as reported by Dula et al. in Mozambique [35]. Concerns on side effects and the efficacy of the vaccine, which were cited by the respondents, were also consistent with previous studies on health workers [23, 25, 28].

Health workers play a crucial role in the control of COVID-19 transmission and the promotion of public health measures, such as vaccination, that mitigate the spread of COVID-19. As such, it is vital to increase their vaccination rates. A rapid evidence appraisal of influenza vaccination among health workers has shown that mandatory vaccination was the sole single approach intervention that improved vaccine uptake. However, it is worthy to note that in lieu of such a mandate, other multifaceted approaches such as those that addressed access to vaccines, knowledge and behavior change, and incentives were successful in increasing uptake [36]. These strategies can be explored when developing interventions aiming to improve health workers' perceptions and behavioral intention towards COVID-19 vaccination at the local context.

Some limitations must be considered when interpreting the findings of this study. Due to its cross-sectional nature, causation between the variables of interest cannot be established by the study. The city district which was included in the study was selected purposively, affecting the generalizability of the findings. Finally, the results of the study are based on self-reported data and are, thus, subject to social desirability bias.

## Conclusion

The study demonstrated that most of the participating health workers had good knowledge of the COVID-19 infection but almost half reported having little to moderate knowledge on the COVID-19 vaccines. Health workers play a crucial role in the control of COVID-19 transmission and the promotion of public health measures, such as vaccination, that mitigate the spread of COVID-19. The findings of the study confirm the need for designing evidence-based health communication campaigns on the safety and efficacy of COVID-19 vaccines to prevent the spread of false information and promote the uptake of the vaccines among health workers, and ultimately, the public. It also highlights the need for stakeholders collaboration to increase confidence in and uptake of the COVID-19 vaccines among health workers.

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## Conflict of Interest

All authors declare no competing interests.

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