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COVID-19 Vaccine Acceptance and Associated Factors among Unvaccinated Workers at a Tertiary Hospital in Southern Thailand

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Abstract

Background: Hospital workers are at high risk of COVID-19 infection which is now vaccine-preventable. However, vaccine refusals also occur among hospital workers, but the associated factors have not been described.

Objectives: To describe: (1) the level of COVID-19 vaccine acceptance, and; (2) the extent that history of pre-pandemic vaccine hesitancy and health beliefs regarding COVID-19 were associated with COVID-19 vaccine acceptance among workers at a tertiary hospital in southern Thailand.

Methods: We conducted a cross-sectional study using a paper-based self-administered questionnaire at a tertiary hospital in south Thailand in April 2021 and used multivariable logistic regression to identify psychological-behavioral factors associated with vaccine acceptance.

Results: Of 359 workers invited to participate, 226 participants returned the questionnaires, 67% of whom reported willingness to accept the vaccine. Vaccine acceptance was associated with perceived severity of disease (Adjusted OR = 2.07, 95% CI = 1.04, 4.10), perceived harm from non-vaccination (Adjusted OR = 2.51, 95% CI = 1.27, 4.96), and lower expectation of vaccine efficacy (Adjusted OR = 3.80, 95% CI = 1.87, 7.71).

Conclusion: Most workers in this study were willing to accept the COVID-19 vaccine, and such acceptance was associated with components of the health belief model. However, the cross-sectional study design did not allow causal inference, and study data were all self-reported with no probing of the responses. These limitations should be considered as caveats in the interpretation of the study findings.

Keywords

COVID-19, vaccine acceptance, healthcare worker, tertiary hospital

Introduction

As of December, 2021, there have been more than 267 million confirmed cases of COVID-19, and more than 5 million deaths.[1] Hospital workers have higher exposure to COVID-19 compared to the general population.[2] Vaccination is considered to be the most effective form of prevention against COVID-19. Although hospital workers are prioritized for receiving COVID-19 vaccine, they are also known to refuse vaccination.[3–5] Information regarding vaccine acceptance among hospital workers and its associated factors is thus relevant to stakeholders in COVID-19 prevention and control.

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Most quantitative studies on vaccine acceptance have used structured questionnaires with binary "Yes/No" responses[6–8] or Likert Scale multiple-choices questions on level of agreement with a given statement.[4,5,9,10] Such measurement methods may not completely reflect the construct of vaccine acceptance in real-world situations. Furthermore, some studies only measured vaccine hesitancy,[5,9,11,12] which covers a narrower spectrum of belief and decision than acceptance.[13] Studies on factors associated with COVID-19 vaccine acceptance showed that acceptance was associated with occupation, age, sex,[8,9] working environment, policy and protective equipment,[3] as well as psychological factors including the "5C" (complacency, constraints, calculation, confidence, and collective responsibility),[14] and vaccine-related attributes (efficacy, protection duration, adverse effects, national origin of vaccine, approval by regulating authorities, and endorsement entity).[15] However, we have found no study that explored all of these factors simultaneously in order for the factors to account for one another's confounding effects in the assessment of their associations with vaccine acceptance.

Songklanagarind Hospital, Hat Yai, Thailand is a tertiary hospital with its capacity to accommodate up to 855 beds that serves as the referral facility for severe COVID-19 cases. Hospital workers are at high risk of exposure to COVID-19 infection. Assessment of prevalence of vaccine acceptance and related determinants among hospital workers are important to provide empirical evidence for relevant stakeholders in infection control and control of communicable diseases. The objectives of this study were to describe: (1) the level of COVID-19 vaccine acceptance, and; (2) the extent that history of pre-pandemic vaccine hesitancy and health beliefs regarding COVID-19 were associated with COVID-19 vaccine acceptance among workers at a tertiary hospital in southern Thailand.

Materials and Methods

Study Design and Settings

We conducted a cross-sectional study using paper-based self-administered questionnaires from 31st March to 28th April in 2021 at Songklanagarind Hospital, Hat Yai, Songkla Province, Thailand.

Study Population

We included two populations: healthcare workers (HCWs, including doctor, allied health professional, nurse, and nursing assistants) at Songklanagarind Hospital who treated COVID-19 cases and non-medical workers (office staff, maintenance staff, housekeepers, and others).[16]

Our inclusion criteria were: (1) being on the roster of staff at Songklanagarind Hospital; (2) aged 18 years and older, and; (3) functional literacy in Thai language. We excluded those who had already been vaccinated against COVID-19.

The Royal Thai Government started vaccine deployment at the end of February 2021, and healthcare staff at the study hospitals were informed of the COVID-19 vaccine's potential availability in March 2021, but were not informed which vaccine they were to receive. The vaccine was later confirmed to be Sinovac. However, very few workers had received the vaccine at the time of data collection; most workers were in the process of considering the vaccination offer. Furthermore, there was no vaccine mandate in Thailand at the time.

Sample Size

We assumed that the level of vaccine acceptance in this study was the same as in a previous study at 70% or higher.[17] At 5% margin of error and 95% level of confidence, we calculated the sample size using R and epicalc package[18] and obtained a sample size of 323 workers. Assuming 10% refusal to participate, the final sample size was 359 workers (n = 359).

Sampling Technique

We distributed the questionnaires to all 19 departments at the study hospital. The number of questionnaires sent to each department varied by probability proportional to size,[19] and can be found in Supplementary Table 2.

Study Variables

Vaccine acceptance (outcome) refers to "a spectrum of behaviors and beliefs from rejection of all vaccines to active support of immunization recommendations".[20] Similar to previous studies,[4,10,21–24] multiple-choice questions on willingness to take the vaccine when available were adapted and changed into multiple binary questions.

Vaccine hesitation history refers to respondents' history on whether they ever refused, postponed or accepted non-COVID-19 vaccination in the past.

Psychological factors refer to attributes of respondents' psyche and thought process that could influence their vaccine acceptance, which were measured using Likert scale and based on the "5C" psychological factors (namely, complacency, constraints, calculation, confidence, and collective responsibility).[14] We modified questions from a previous study[14] to suit the context of COVID-19 pandemic and the socio-cultural context of the study setting.

COVID-19 related health beliefs refer to constructs defined by the Health Belief Model (HBM),[10] with modifications to suit the context of COVID-19 and COVID-19 vaccination, including perceived severity and susceptibility to COVID-19 and perceived benefits of COVID-19 vaccination.

Organizational factors refer to characteristics of the respondents' department or unit, including policy related to the policy of availability of personal protective equipment, isolation rooms, social distancing measures, hand hygiene, respiratory hygiene, disinfection measures, protective training, screening tests and triage system.[25]

Vaccine attributes refer to characteristics of the vaccine with regards to a vaccine's efficacy, interval between two

doses, adverse effects, approval by public health authorities, country of production/origin, adverse effect, affordability.

Demographic characteristics refer to the characteristics and personal attributes of the respondents, including gender, age in years, religion, occupation, and health problems that might counter-indicate vaccination.

Study Instrument

The study instrument was a self-administered paper-based questionnaire with 48 items in total. Each questionnaire took approximately 15 min to complete. The questionnaire was developed under the supervision of a content matter expert who validated the questions during an iteration process. The questionnaire was developed in the English language then translated into Thai language. The research team back-translated the questionnaire from Thai into English to validate the Thai translation, and resolve parts where discrepancies between the original and back-translated versions were found. The research team pilot-tested the study instruments with 30 participants from the study hospital's Nursing Department from March 18th to March 24th, 2021. The pilot study participants were not included in the main study. An English version of the final questionnaire can be found in *Supplemental Material 1*.

Data Collection Procedures

The research team contacted the head of each department at the Hospital to inform them about the study and request their permission to collect data. A cover letter explaining the study's purpose with copies of the questionnaire and a cardboard box to the heads of each department of the hospital were sent and requested them to distribute the questionnaire to their staffs to participate into the study at their own discretion. In each questionnaire, a separate participant information sheet and an informed consent form (2 copies) were attached to be signed by the respondent and then need to send back.

The informed consent form included the project title, a summary of the purpose, procedure, risks and discomfort, benefits, confidentiality issues pertaining to the study, and contact information of the principal investigator and the Human Research Ethics Committee. The form also contained a space where the participants would confirm that they had given consent freely by signing their name, the printed name, and the date of signing the form. There was also a box where participant can check to declare that "*[ ] I am willing to participate but do not wish to sign or write my name*". At the bottom of the form, the investigators included a reminder "*Please DO NOT remove this form from the questionnaire*".

The completed questionnaires were placed in the cardboard box and requested to send back to the research team within the 14 business days. After receiving the completed questionnaire and informed consent form, investigators separated the informed consent forms from the questionnaire and stored the forms in a secure location.

Data Management and Analysis

Research team members performed double data entry of questionnaire responses and assessed validation using EpiData software version 3.1. Research team members then cleaned the data and exported the data to R. Background characteristics of the respondents and the primary outcomes of the study were summarized using mean, frequencies and proportions. We assessed the association between vaccine acceptance and history of past non-COVID-19 vaccine hesitancy, components of the health belief model, perceived organizational support, and opinions regarding vaccine attributes using multivariate logistic regression analyses, with the exposure variables adjusting for one another. We did not adjust for general characteristics of the study participants as they were not significantly associated with vaccine acceptance and thus did not fit the criteria for confounding factors (Supplementary Table 1).

Ethical Considerations

This study received ethical approval from the Human Research Ethics Committee of the Faculty of Medicine, Prince of Songkla University (Approval Number: REC.64-090-18-2).

Results

A total of 226 out of 359 hospital workers filled and returned the questionnaires (response rate = 63.0%). The mean age of the participants was less than 40 years (Table 1). Most participants were female, Buddhists, and had no health problems that made them worried about COVID-19 vaccination. The distribution of

Table 1. General Characteristics of the Study Participants (n = 226 Hospital Workers).

Variables	Frequency (%) (N = 226)
Gender	
Male	23 (10.18)
Female	203 (89.82)
Age (years)	
Mean (SD)	38.88 (10.66)
Occupation*	
Healthcare workers	168 (74.01)
Non-medical workers	59 (25.99)
Religion**	
Buddhism	208 (91.63)
Others	19 (8.37)
Health problems that might counter-indicate vaccination	
Yes	42 (18.50)
No	185 (81.50)

*Healthcare workers included doctors, allied health professionals, nurses, and nursing assistants; Non-medical workers included office staff, maintenance staff, housekeepers, and others; ** Others religions included Islam, Christianity, and others.

Table 2. Hesitation History, Vaccine Attributes, Psychological and Organizational Factors Regarding COVID-19 Vaccination among Study Participants (n = 226 Hospital Workers).

Item	Frequency (%)
History of non-COVID-19 vaccine hesitancy	
Ever refused vaccine because considered useless*	25 (11.3)
Ever refused vaccine because considered dangerous*	18 (8.1)
Ever postponed physician-recommended vaccination*	21 (9.5)
Ever had vaccine despite doubt about efficacy*	51 (23.4)
Ever had any prior history of non-COVID-19 vaccine hesitancy*	84 (38.5)
Vaccine attributes related to COVID-19 vaccine acceptance	
Minimal efficacy needed to accept vaccination	
[Must be] 100% (very high expectation)	73 (32.6)
At least 75% [75%-99%]	119 (53.1)
At least 50% [50%-100%]	25 (11.2)
At least 25% [25%-100%]	0 (0.0)
Any efficacy level is fine [0-100%]	7 (3.1)
Maximum interval between dose	
2 weeks or less	31 (14.0)
3 weeks or less	36 (16.2)
1 month or less	75 (33.8)
3 months or less	18 (8.1)
Any interval is fine	62 (27.9)
Factors considered as important for decision to receive vaccine	
The vaccine's country of origin	217 (96.9)
Approval by authorities	225 (99.6)
Not paying out-of-pocket for the vaccine	189 (83.6)
Adverse effects after vaccination	226 (100.0)
[Favorable] Opinions related to COVID-19 vaccination	
I am completely confident that most COVID-19 vaccines are safe (% agree).	92 (41.1)
Vaccination against COVID-19 is unnecessary (% disagree).	219 (97.8)
I feel that there are problems that will prevent me from getting. Vaccinated against COVID-19 if I want to (% disagree).	193 (86.9)
I get vaccinated against COVID-19 to protect people with a weaker immune system (% agree).	165 (75.3)
Favorable opinion score (mean ± SD)	3.01 ± 0.25
***Health beliefs** about COVID-19 Disease and COVID-19 Vaccination*	
Perceived Severity: Will die/be permanently disabled if infected with COVID-19	132 (58.9)
Perceived Susceptibility: Will get COVID-19 infection at least once within next 12 months	20 (9.0)
Perceived Benefits: Will be protected from COVID-19 infection after receiving vaccine	118 (52.4)
Perceived Harm: The vaccine benefits outweigh the harm	182 (80.9)
Health belief score (mean ± SD)	2.01 ± 0.30
Organizational Support	
Supply of personal protective equipment is adequate to prevent COVID-19 infection.	168 (75.3)
My hospital's nosocomial infection control protocol is effective in preventing COVID-19.	165 (74.0)
My hospital is effectively implementing social distancing measures.	149 (66.2)
My hospital provides sufficient facilities for hand hygiene.	192 (85.7)
My hospital strictly encourages respiratory hygiene.	192 (86.1)
My hospital provides a sufficient amount of disinfectants and disposable towels.	174 (78.0)
My hospital has adequately trained me to be safe from COVID-19 infection.	172 (77.1)
My hospital's screening practices follow National COVID-19 Guidelines.	175 (79.2)
My hospital's triage system can rapidly identify and isolate patients with respiratory illness.	165 (74.0)
Organizational support score (mean ± SD)	6.96 ± 0.06

*Not sure recoded as NA (missing data).

the participants by department within the study hospital can be found in Supplementary Table 2.

Two-fifths of participants reported history of vaccine hesitation (Table 2). Nearly all participants considered the vaccine's country of origin, approval by authorities, and adverse effects after vaccination as important factors. With regard to vaccine-related opinions, although less than half of all participants agreed that the vaccines were completely safe, they also reported

Table 3. COVID-19 Vaccine Acceptance and Delays, Reasons for Delay, and Choice of Vaccine (n = 227 Hospital Workers).

Item	Frequency (%)
Vaccine Acceptance: If you are offered the COVID-19 vaccine today for free by PSU Hospital, what will you do?	
Will refuse to vaccinate	61 (27.6)
Will tell others not to vaccinate	13 (5.9)
Will recommend others to receive vaccine	142 (64.5)
Will receive vaccine	158 (71.8)
Categories of acceptance	
The refusers: answered yes to 1 or more refusal question AND none of the acceptance question	40(18.1)
The acceptors: answered yes to none of the refusal question AND at least 1 acceptance question	148(67.0)
The inconclusive: answered yes to at least 1 refusal question AND at least 1 acceptance question OR answered no to all questions	33(14.9)
Will ask for delay	107 (50.2)
The reasons among those who asked for delay:	n = 107
Want to wait for vaccine with lower risk of adverse effect	99 (92.5)
Want those who are more vulnerable to get the vaccine first.	92 (86.0)
Want to wait for a more effective vaccine.	97 (93.3)
Want to see the complete trial result first before I decide whether to vaccinate	101 (94.4)
Have received other vaccines that may negatively interact with COVID-19 vaccine.	7 (6.5)
Already have enough protection from other preventive measures.	45 (42.1)
My friends or family have advised me to delay.	23 (21.5)
My superiors have advised me to delay.	5 (4.7)
Preference when presented with facts about Sinovac and AstraZeneca vaccines and asked to choose:	
Sinovac	116 (53.5)
Astra	13 (6.0)
Neither	34 (15.7)
Not sure	54 (24.9)

that they would vaccinate to protect people with a weaker immune system. With regard to health belief, just slightly more than half of the participants reported perceived severity of COVID-19 infected and perceived benefit of COVID-19 vaccination, although four-fifths agreed that the benefits of the vaccine outweighed the potential harms. Most participants had a favorable opinion of their hospital's effort to prevent nosocomial infection.

Most participants were willing to receive COVID-19 vaccine and recommend it to others when the vaccine is available at the hospital for free (Table 3). We considered approximately 67% of the participants to be vaccine acceptors, 18% to be refusers, and 15% to be inconclusive (ie, reported self-contradicting answers). Half of the participants indicated intention to delay vaccination, with the common concerns being adverse effects, preference to wait for more effective vaccines, preference to wait for complete trials results, and preference for those who were more vulnerable to receive the vaccine first. When presented with facts about Sinovac and AstraZeneca vaccines, most participants answered that they would prefer Sinovac, although one-fourth were unsure.

Multivariate logistic regression analyses (Table 4) showed that after adjusting covariables, participants who indicated perceived severity were 2.07 times more likely to accept the vaccines than participants who did not. Participants who perceived harm from non-vaccination (ie, disagreed that adverse effects outweigh the benefits) were 2.51 times more likely to accept the vaccine than those without perceived harm. Participants who did not expect 100% vaccine efficacy were 3.8 times more likely to accept the vaccine than participants who did.

Discussion

Among workers at the study hospital, we found that two-thirds of the participants would accept the COVID-19 vaccine and factors associated with vaccination included perceived severity of COVID-19, perceived harms of non-vaccination, and not expecting vaccine to be 100% effective. The findings of our study can potentially provide empirical evidence to support stakeholders in the decision-making process.

The prevalence of vaccine acceptance among healthcare workers (doctors, nurses, nurse assistants) was higher than non-medical workers, which was similar with the studies conducted in Israel and France, but was much higher than studies in Hong Kong, Congo and Malta.[26] HCWs are at a higher risk of infection than non-medical workers,[2] which could have accounted for the higher vaccine acceptance. Another reason might be that HCWs might have gained more knowledge about COVID-19 and its effects on human health, so they might have been more willing to accept the vaccine when it became available. Although we excluded those who had already received the COVID-19 vaccine from our study, such vaccination was very uncommon during the study period. Private vaccination was not available in early 2021, and organizations in the Royal Thai Government

Table 4. Associations Between Potential Behavioral Drivers for Vaccination and COVID-19 Vaccine Acceptance [n = 205 Hospital Workers].

Exposure Variables	Refused Vaccine or Inconclusive	Accept Vaccine	Crude OR (95% CI)	Adjusted* OR (95% CI)
Vaccine Hesitancy: Any prior history of non-COVID-19 vaccine hesitancy*				
No	44 (33.3)	88 (66.7)	1.0 (*Ref.*)	1.0 (*Ref.*)
Yes	25 (30.1)	58 (69.9)	1.16 (0.64,2.1)	1.05 (0.53,2.11)
Components of health belief model				
Perceived Severity				
No	34 (38.2)	55 (61.8)	1.0 (*Ref.*)	1.0 (*Ref.*)
Yes	39 (30.2)	90 (69.8)	1.43 (0.81,2.52)	**2.07 (1.04,4.1)**
Perceived Susceptibility				
No	65 (33.0)	132 (67.0)	1.0 (*Ref.*)	1.0 (*Ref.*)
Yes	8 (40.0)	12 (60.0)	0.74 (0.29,1.9)	0.55 (0.19,1.63)
Perceived benefits of vaccination				
No	44 (43.1)	58 (56.9)	1.0 (*Ref.*)	1.0 (*Ref.*)
Yes	29 (24.8)	88 (75.2)	**2.3 (1.3,4.09)**	1.82 (0.93,3.56)
*Perceived harms of non-vaccination**				
No	53 (44.5)	66 (55.5)	1.0 (*Ref.*)	1.0 (*Ref.*)
Yes	20 (20.0)	80 (80.0)	**3.21 (1.75,5.91)**	**2.51 (1.27,4.96)**
Organizational support score (mean ± SD)	6.3 ± 2.6	7.3 ± 2.3	**1.16 (1.04,1.3)**	1.13 (0.99,1.3)
Vaccine attributes related to COVID-19 vaccine acceptance				
Minimal efficacy needed to accept vaccination				
Must be 100%	37 (52.1)	34 (47.9)	1.0 (*Ref.*)	1.0 (*Ref.*)
Less than 100%	33 (22.4)	114 (77.6)	**3.76 (2.05,6.89)**	**3.80 (1.87,7.71)**
Maximum interval between dose				
Specified interval	58 (36.9%)	99 (63.1%)	1.0 (*Ref.*)	1.0 (*Ref.*)
Any interval is fine	12 (20.0%)	48 (80.0%)	**2.34 (1.15,4.77)**	1.53 (0.68,3.43)

Bold numbers denote statistical significance.
*Each exposure variable was adjusted for all other exposure variables.

had to follow strict rules and procedures to distribute the vaccine. In this context, it was unlikely that the exclusion of those who had received vaccination introduced selection bias to our study findings. However, there was an unexpected outbreak of COVID-19 in the local area at the time of our data collection, which delayed the completion of our data collection period by 2 additional weeks. These events could have influenced the level of vaccine acceptance among our participants, and the findings of this study might have limited generalizability to other contexts.

Two parts of the Health Belief Model were associated with COVID-19 vaccine acceptance: perceived severity of COVID-19 and perceived harm from non-vaccination. The association with perceived severity was consistent with a population-based survey in Hong Kong,[27] but not in China.[28] The association between vaccine acceptance and perceived harm from non-vaccination was consistent with the finding of other studies.[10,15] Similarly, the association between expected vaccine efficacy and vaccine acceptance in our study was similar to that of a previous study,[29] although our method of categorization might have differed from others[15] and could have limited the comparability of our study findings.

One point of consideration was that we measured the exposure (ie, expected efficacy) and outcome (ie, vaccine acceptance) in our study using a relatively indirect methods, ie, a multiple choice questions with 5 possible responses for the expected efficacy of COVID-19 vaccine and multiple yes/no questions to measure vaccine acceptance, while a previous study[15] measured vaccine acceptance using scenarios with randomized vaccine attributes. Future studies should consider incorporating techniques from other studies that might yield more detailed data.

Strengths and Limitations

Our study had several strengths. Firstly, we used proportionate sampling, which improved the representativeness of the responses to the population that gave rise to our participants. Secondly, we used paper-and-pencil questionnaires, which did not preclude participation by hospital workers who had limited internet access or were concerned about their privacy like in previous studies.

A number of limitations should be considered in the interpretation of the study findings. Firstly, the study was a cross-sectional, thus causality could not be inferred. Secondly, we used self-administered questionnaire, which did not allow for probing of the participants' responses, limiting the amount of details available. Thirdly, fewer than 90% of the delivered questionnaires were returned (ie, response rate was less than 90%), thus the potential selection bias from non-response was

non-negligible. Lastly, our study data were collected during a new wave of COVID-19 outbreak and at a time when hospital workers were informed that they were to receive a vaccine. The findings of this study might have limited generalizability to other contexts.

Conclusion

In this cross-sectional study, we assessed the level of COVID-19 vaccine acceptance and its association with components of health belief model and other attributes among workers at a tertiary hospital in southern Thailand. We found that most hospital workers would like to accept the COVID-19 vaccine, and that perceived severity of COVID-19 infection, perceived harm of non-vaccination, and more lenient expectation of vaccine efficacy were significantly associated with vaccine acceptance. However, the cross-sectional study design and issues pertaining to measurements should be considered as caveats in the interpretation of the study findings.

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Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

This study received ethical approval from the Human Research Ethics Committee of Prince of Songkla University (REC 61-366-18-1).

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Consent to Participate

Participants' consent were obtained before the survey.

Author Contributions

Guanjie Li, Wit Wichaidit, Yanxu Zhong, Hein Htet, Yunyan Luo, Xizhuo Xie contributed equally in initializing the study, designing the survey, collecting and analyzing and interpreting the data, and writing the draft report. Guanjie Li and Wit Wichaidit contributed to the writing of this manuscript.

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Supplemental material

Supplemental material for this article is available online.

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