

Acceptance of COVID-19 Vaccination and Vaccine Hesitancy Among People with Chronic Diseases in Thailand: Role of Attitudes and Vaccine Literacy Towards Future Implications

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Introduction: Vaccination is an important strategy to prevent or reduce hospitalizations and mortality caused by COVID-19 infection. However, some people with chronic diseases are hesitant to get the COVID-19 vaccination.

Objective: This study aimed to assess the acceptance of COVID-19 vaccination and associated factors among people with chronic diseases.

Methods: A cross-sectional online survey was conducted between May and August 2021. A sample of 457 Thai adults living with one or more chronic diseases was drawn from a larger online survey.

Results: Participants were 19 to 89 years old. The three most commonly reported chronic diseases were hypertension, diabetes, and obesity. The acceptance rate of COVID-19 vaccination was 89.1%. Forty-six percent of respondents had received the COVID-19 vaccination, and 43.1% intended to get the vaccine. Reasons for vaccine hesitancy/refusal included concerns about adverse side effects from the vaccines including long-term effects that might complicate their disease condition. Multiple logistic regression analyses revealed that having a bachelor's degree or higher [aOR 4.40; 95% CI: 2.12–9.14], being employed [aOR 2.11; 95% CI: 1.03–4.39], and having positive attitudes [aOR 2.36; 95% CI: 1.69–3.29] and negative attitudes [aOR 0.38; 95% CI: 0.27–0.55] predicted acceptance of the COVID-19 vaccination. Vaccine literacy was significantly associated with acceptance of COVID-19 vaccination in binary logistic regression analyses, but it was not retained in the multiple logistic regression model.

Conclusion: Vaccine literacy and attitudes influence acceptance of COVID-19 vaccination in people with chronic diseases.

Keywords: COVID-19, vaccine, vaccine literacy, attitudes, acceptance of COVID-19 vaccination, chronic diseases, Thailand

Introduction

The surge of COVID-19 cases and deaths has impacted people worldwide.¹ Those with chronic diseases are at high risk for hospitalization and ICU admission^{2–4} and mortality.^{2,4–9} The most common chronic diseases associated with severe COVID-19 conditions are hypertension,^{10,11} diabetes,¹¹ heart disease,¹¹ stroke,¹² chronic lung diseases,¹³ cancer,¹⁴ and obesity.¹⁵ Having a comorbidity increases the COVID-19 mortality rate by 10.89 times.¹⁶ Patients with hypertension have a mortality rate 3.64 times higher, and those with chronic pulmonary disease have a mortality rate 2.93 times higher when compared with those with no co-morbidity.¹⁶

The first case of COVID-19 in Thailand was identified in January 2020.¹⁷ From the start of the pandemic through July 4, 2021, 283,067 persons were reported to be infected with COVID-19. The reported cumulative deaths increased from 34 (March 31, 2021) to 2132 (July 4, 2021).¹⁸ By the end of 2021, over two million people had been infected with COVID-19, and 21,698 deaths had been reported.¹⁹ During these periods, 90% of the deaths were elderly people and

people with an underlying chronic disease.^{18–21} Most elderly people with chronic diseases required ventilator support during their period of critical illness with COVID-19.²²

During Thailand's third wave of infection, priority to receive the COVID-19 vaccine was given to frontline healthcare workers, followed by older adults and people living with underlying health conditions such as chronic respiratory diseases, cardiovascular diseases, chronic kidney diseases, cerebrovascular diseases, cancer, diabetes mellitus, and obesity.¹⁷ Although COVID-19 vaccines are known to be safe and effective,²³ some people with chronic diseases are hesitant to be vaccinated.^{24–26} Factors commonly associated with COVID-19 vaccine hesitancy include concerns about vaccine safety and side effects,^{24,27} concerns regarding vaccine efficacy,²⁷ lack of trust,²⁸ and postponing vaccination to observe results.²⁷ Hesitancy rates for COVID-19 vaccination have varied across countries, especially in low- and middle-income countries.²⁹

Although the World Health Organization recommends that receiving a COVID-19 vaccination is the most effective way to decrease the severity of COVID-19 infection,³⁰ many people worldwide have been uncertain whether the vaccines provide the promoted health benefits, especially for those with chronic diseases. A global survey reported that acceptance rates of COVID-19 vaccination among people with chronic diseases vary widely across countries.³¹ Approximately 58.5% to 63% of people in low and middle-income countries have reported acceptance of COVID-19 vaccination.^{32,33} In the initial phase of the pandemic, the overall COVID-19 vaccination acceptance rate in the general Thai population ranged from 41.1%³⁴ to 67%.³⁵

Studies show that sex,^{36,37} age,^{37–40} educational level,^{36,37,41} marital status,⁴² working status,⁴³ income,^{32,37} vaccine literacy (VL),^{44,45} and attitudes toward COVID-19 vaccination^{30,41,45–48} are significant factors associated with acceptance of COVID-19 vaccination across a general population, as well as older adults⁴⁵ and those with chronic diseases.⁴¹ In addition to individual characteristics, previous studies on COVID-19 vaccination revealed that positive attitudes toward vaccines have a positive effect on individuals' willingness to be vaccinated, while negative attitudes are associated with vaccine hesitancy.⁴⁹ People who have positive attitudes have higher rates of vaccine acceptance, whereas those with negative attitudes are more likely to equivocate or decline vaccination.^{24,41,45,48,49} In addition, VL has also been regarded as another important factor influencing vaccine acceptance.^{37,44,45,49,50} VL refers to individuals' ability and skills to seek out and understand information needed for appropriate decision-making on vaccination.^{44,50}

COVID-19 vaccine acceptance rates, reasons for acceptance or hesitancy, VL, and attitudes toward COVID-19 vaccines have not previously been reported among Thai people with chronic diseases. Thus, this study aimed to assess these views and identify factors influencing acceptance of COVID-19 vaccination among people with chronic diseases in Thailand.

Materials and Methods

Study Design

This study is part of a larger online cross-sectional survey entitled “Trend analysis of COVID-19 vaccination, vaccine literacy, attitudes towards COVID-19 vaccines, and intention to vaccinate against COVID-19 in Thailand”, which recruited 2,634 participants from all regions of Thailand between May and August 2021.

Study Sample

A subset of 457 people with one or more chronic diseases was drawn from the larger dataset of 2,634 participants who had been recruited using convenience sampling. The inclusion criteria for the subset of people were: (1) 18 years or older, and (2) at least one chronic disease (ie, chronic respiratory diseases, cardiovascular diseases, chronic kidney diseases, cerebrovascular diseases, cancer, diabetes mellitus, or obesity). The calculated acceptance rate in the main study was 98.39%.

The sample size for logistic regression was estimated based on event per variable (EPV), using the sample size formula $n = 100 + xi$, where x is an integer of EPV and refers to the number of independent variables. An EPV of 30 was selected. The minimum sample size for logistic regression involving 10 independent variables was 400.⁵¹ However, 457 people with at least one chronic disease using the inclusion criteria were identified in the dataset.

Data Collection and Instruments

To recruit respondents to the larger study, messages containing a web link and a quick response code (QR code) were placed on e-posters and distributed via Facebook, individual and group Line accounts (<https://line.me>), and other social network groups. People who received the messages could re-distribute them to their friends, family, and their networks. Participants responded to online questionnaires on Google forms through a web link and a QR code. Online survey questions elicited participants' sociodemographic characteristics (age, sex, educational level, marital status, working status, income, health conditions, and illnesses), COVID-19 vaccination, vaccination intention, attitudes toward COVID-19 vaccination, and COVID-19 vaccine literacy. Prior to data collection, a pilot study was conducted among 40 participants to test internal consistency reliability of the questionnaires. The pilot study yielded adequate Cronbach's alpha reliability coefficients for the overall vaccine literacy scale (0.81)⁵² and the COVID-19 attitude scale (0.71).⁴⁵

Acceptance of COVID-19 Vaccination

COVID-19 vaccination acceptance was measured by two items:⁵² "Have you received the COVID-19 vaccination?" (Yes, No). "Do you intend to receive the COVID-19 vaccine?" (Will get it for sure / Not sure / Will not get it). Acceptance of COVID-19 vaccination was categorized as acceptance (a combination of people were vaccinated and intended to vaccinate for sure) or hesitancy (a combination of people who were not sure and refused to get the vaccine).

COVID-19 Vaccine Literacy (COVID-19 VL)

The original COVID-19 Vaccine Literacy scale⁴⁴ was translated into the Thai language using back translation.⁵² The scale's two subscales are functional literacy and interactive/critical literacy. The four-item functional literacy subscale has a negative focus and uses a four-point response option (4 = Never, 3 = Rarely, 2 = Sometimes, 1 = Often). The eight-item interactive/critical literacy subscale has a positive focus and also uses a four-point response option, but starting from 1 = Never to 4 = Often. Scores were calculated by averaging the item responses for each subscale, with higher values corresponding to higher levels of their respective VL. An example of the negative focus is: "Did you find words you did not know?" An example of the positive focus is, "Have you consulted more than one source of information?" In this study, Cronbach's alphas of the functional and interactive/critical subscales and overall skills were 0.85, 0.83, and 0.82, respectively, and were similar to values reported in another study using the scale: 0.85, 0.86, and 0.81 respectively.⁵²

Attitudes Toward COVID-19 Vaccination

Attitudes toward COVID-19 vaccination were measured by a 10-item COVID-19 Attitude Scale, developed and used in previous studies.^{45,49} The scale comprises five positive and five negative attitude items using a 7-point rating scale (1 = Strongly disagree; 7 = Strongly agree). Means were calculated from item responses to positive and negative attitudes separately, with higher values indicating higher levels of their respective attitudes. An example of a positive attitude item is, "Vaccination can reduce the severity of COVID-19." An example of a negative attitude item is, "COVID-19 vaccination can be fatal." In previous studies, Cronbach's alphas for positive and negative scales were 0.88 and 0.72, respectively.⁴⁹ In this study, Cronbach's alphas for the positive, negative, and overall attitudes toward COVID-19 vaccination of this study were 0.79, 0.67, and 0.74, respectively.

Ethical Considerations

The Committee for the Human Rights Related to Research Involving Human Subjects at the Faculty of Medicine Ramathibodi Hospital, Mahidol University, granted permission to conduct the larger project and the present study (COA.MURA 2021/381 and COA.MURA 2022/300). During online recruitment for the project, potential participants were provided with informed consent information including the study's purpose, anonymity of responses, and confidentiality of data (as no IP address was recorded). Those who agreed to take the survey clicked an option to consent before responding. Participation was voluntary with no incentive. Participants could freely skip any questions that they did not want to answer. This study was conducted in accordance with the guidelines of the Declaration of Helsinki.

Data Analysis

Descriptive statistics were used to analyze the participants' sociodemographic characteristics, acceptance of COVID-19 vaccination, COVID-19 VL, and positive and negative attitudes toward COVID-19 vaccination. Graphical rates were used to display the reasons for participants' vaccine acceptance, hesitancy, and refusal. Independent *t*-tests were used to compare functional VL, interactive/critical VL, and positive and negative attitudes toward COVID-19 vaccination by demographic characteristics. Binary and multiple logistic regression analyses were performed to determine factors associated with acceptance of COVID-19 vaccination. The variables with *p*-values < 0.25 in binary logistic regression were identified as candidates for multiple logistic regression models.⁵³ The backward elimination method was applied to estimate the final model. A two-tailed test was used for all analyses using statistical significance at *p*-value of < 0.05. All statistical analyses were performed using IBM SPSS version 28.⁵⁴

Results

Participants' Background Characteristics, COVID-19 Vaccination, Attitudes, and Vaccine Literacy

A majority of participants were from Bangkok and the Central Region of Thailand (Table 1). Two-thirds were females (*n* = 308; 67.4%). The mean age was 52.3 years (*SD* = 12.0), ranging from 19 to 89 years. About half were married (*n* = 223; 48.8%). Most participants had a bachelor's degree or higher (*n* = 367; 80.3%). While more than half were employed (*n* = 241; 52.7%), most participants indicated they had an adequate income (*n* = 372; 81.4%). Over four-fifths of participants had a single underlying chronic disease (*n* = 372; 81.4%), while the remainder had two or more chronic diseases. Frequently reported underlying diseases included hypertension (37.0%), diabetes (35.2%), obesity (33.3%), heart disease (18.4%), cancer (12.9%), lung diseases (9.2%), stroke (8.5%), and chronic kidney disease (4.4%).

Two hundred and ten participants (46%) had received the COVID-19 vaccine. Of all respondents, 43.1% intended to get the vaccine (*n* = 197; 43.1%); 10.3% were uncertain about receiving it (*n* = 47; 10.3%); and 0.7% refused to get vaccinated (*n* = 3; 0.6%). The acceptance rate of COVID-19 vaccination was 89.1% (ie, a combination of the vaccinated with those reporting an intention to vaccinate = 407/457).

Participants' mean item scores on functional VL (*M* = 2.79, *SD* = 0.74) and interactive/critical VL (*M* = 3.35, *SD* = 0.49) were above respective scale midpoints. The mean scores were also above the midpoints for positive attitudes toward COVID-19 vaccination (*M* = 5.75, *SD* = 0.96) and negative attitudes toward COVID-19 vaccination (*M* = 3.97, *SD* = 1.19).

Reasons for COVID-19 Vaccination Acceptance, Hesitancy, and Refusal

Participants identified reasons for accepting COVID-19 vaccination (Figure 1). The three reasons most frequently given were: reducing the severity of COVID-19 symptoms if infected (40.5%), having medical conditions or underlying diseases (38.3%), and achieving of herd immunity (35.9%).

Figure 2 gives the three main reasons the participants gave for vaccination hesitancy. These were: concerns about serious/unsafe side effects (86%), unknown side effects to the human body (82%), and fear of the long-term effects of vaccination (80%).

Among those who refused COVID-19 vaccination (Figure 3), the most frequently reported reasons for vaccination refusal were: the presence of medical conditions or underlying diseases (100%), lack of confidence both in the vaccine's efficacy (100%) and in the vaccine administrative system (100%), the short duration of vaccine development and testing (100%), and reluctance to be an experimental subject or a guinea pig (100%).

Attitudes and Vaccine Literacy by Demographic Characteristics of the Participants

Females scored significantly higher than males on interactive/critical VL (Table 2). Participants who had earned a bachelor's degree or higher scored higher on functional and interactive/critical VL compared with those with less education. Those currently working scored higher on interactive/critical VL than those unemployed. Functional and interactive/critical VL mean scores differed significantly by income. However, no evidence of differences in VL were

Table 1 Sociodemographic Characteristics of People with Chronic Diseases (n=457)

Variables	Frequency	Percent
Region		
Bangkok	220	48.1
Central	128	28.0
North and Northeast	53	11.6
East, West, and South	56	12.3
Sex		
Male	149	32.6
Female	308	67.4
Age, mean = 52.3 years, SD = 12.0, min-max = 19–89 years		
< 60 years	333	72.9
≥ 60 years	124	27.1
Educational attainment		
Less than the Bachelor's degree	90	19.7
Bachelor's degree or higher	367	80.3
Marital status		
Single, separate, widowed	234	51.2
Married	223	48.8
Working status		
Currently working	241	52.7
Not currently working	216	47.3
Income		
Inadequate	85	18.6
Adequate with no savings	178	38.9
Adequate with savings	194	42.5
Acceptance of COVID-19 vaccination		
Vaccinated	210	46.0
Intended to vaccinate for sure	197	43.1
Not sure/maybe get the vaccine	47	10.3
Refused to get the vaccine	3	0.6
Number of chronic disease (s)		
1	372	81.4
≥ 2	85	18.6
Types of chronic diseases*		
Hypertension	169	37.0
Diabetes	161	35.2
Obesity	152	33.3
Heart diseases	84	18.4
Cancer	59	12.9
Lung diseases	42	9.2
Stroke	39	8.5
Chronic kidney disease	20	4.4
Scales	Mean	SD
COVID-19 vaccine literacy		
Functional vaccine literacy	2.79	0.74
Interactive/critical vaccine literacy	3.35	0.49
Attitudes towards COVID-19 vaccine		
Positive attitudes	5.75	0.96
Negative attitudes	3.97	1.19

Note: * Some participants reported more than one disease.

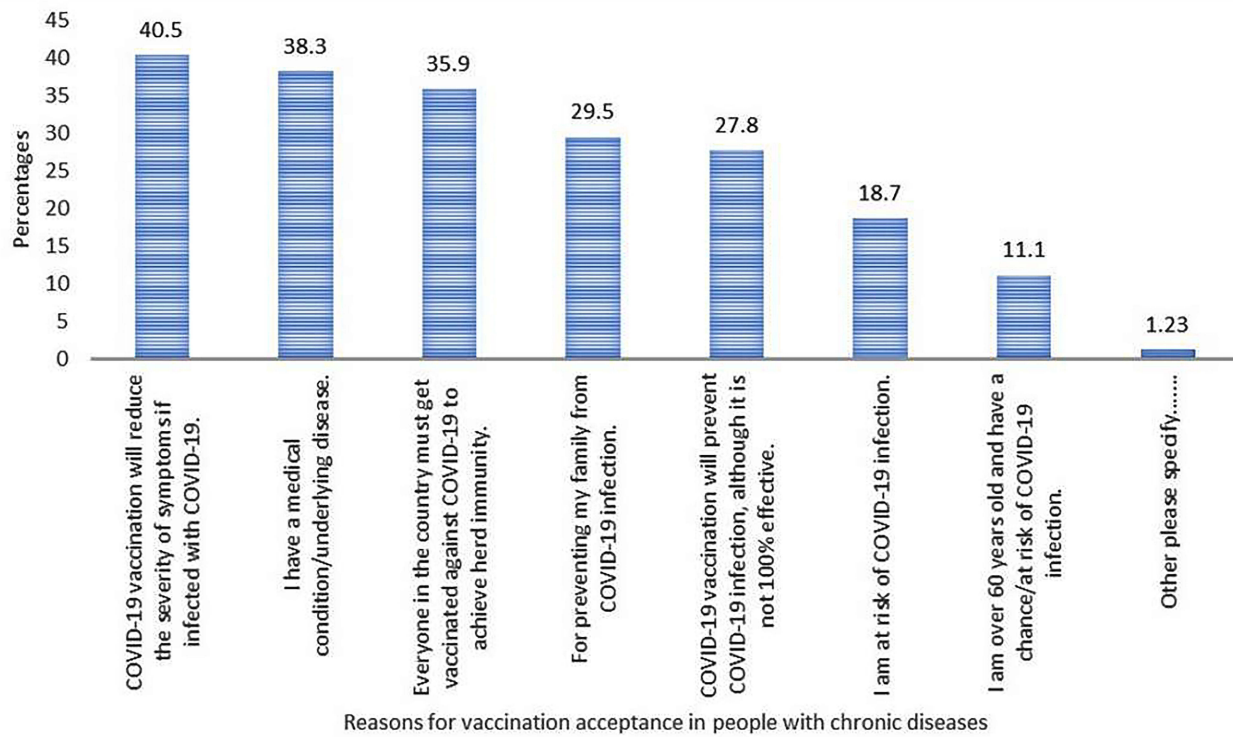


Figure 1 Reasons for vaccination acceptance in people with chronic diseases (n=407).

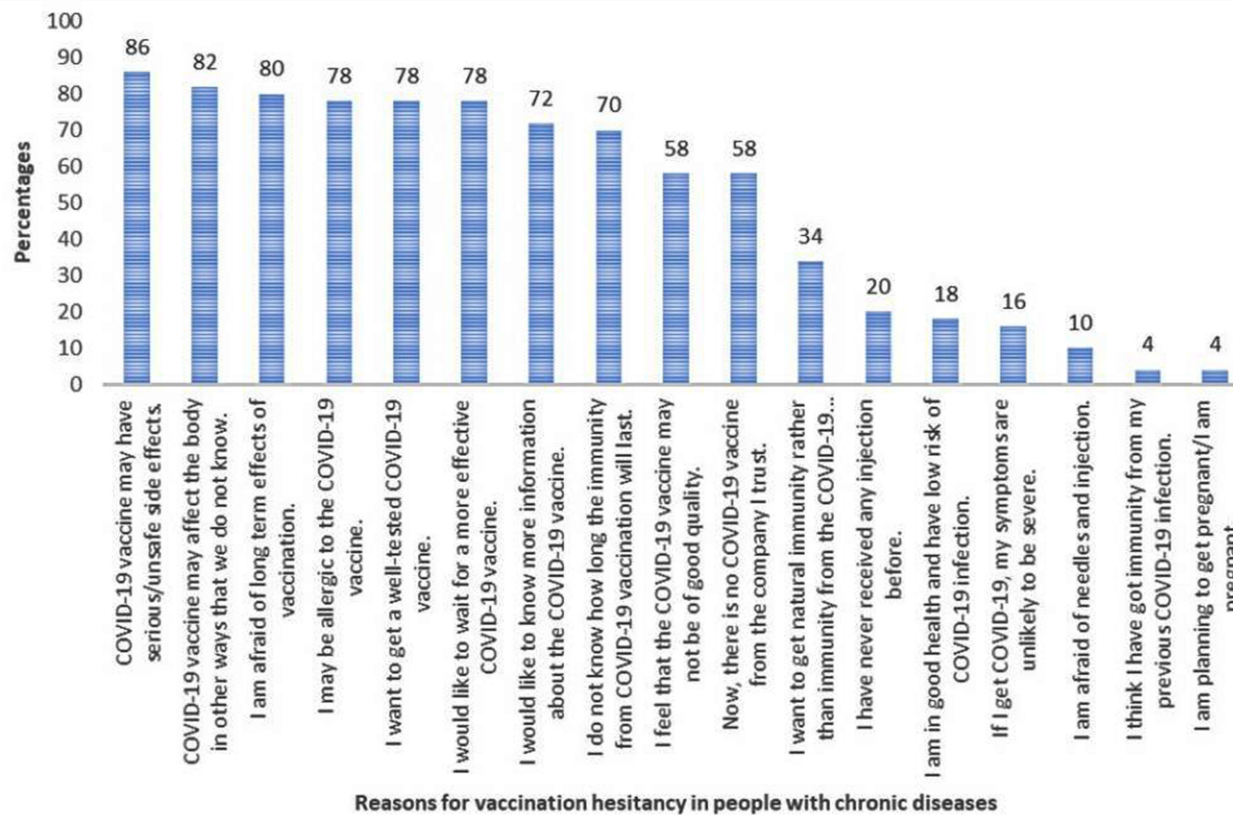


Figure 2 Reasons for vaccination hesitancy in people with chronic diseases (n=47).

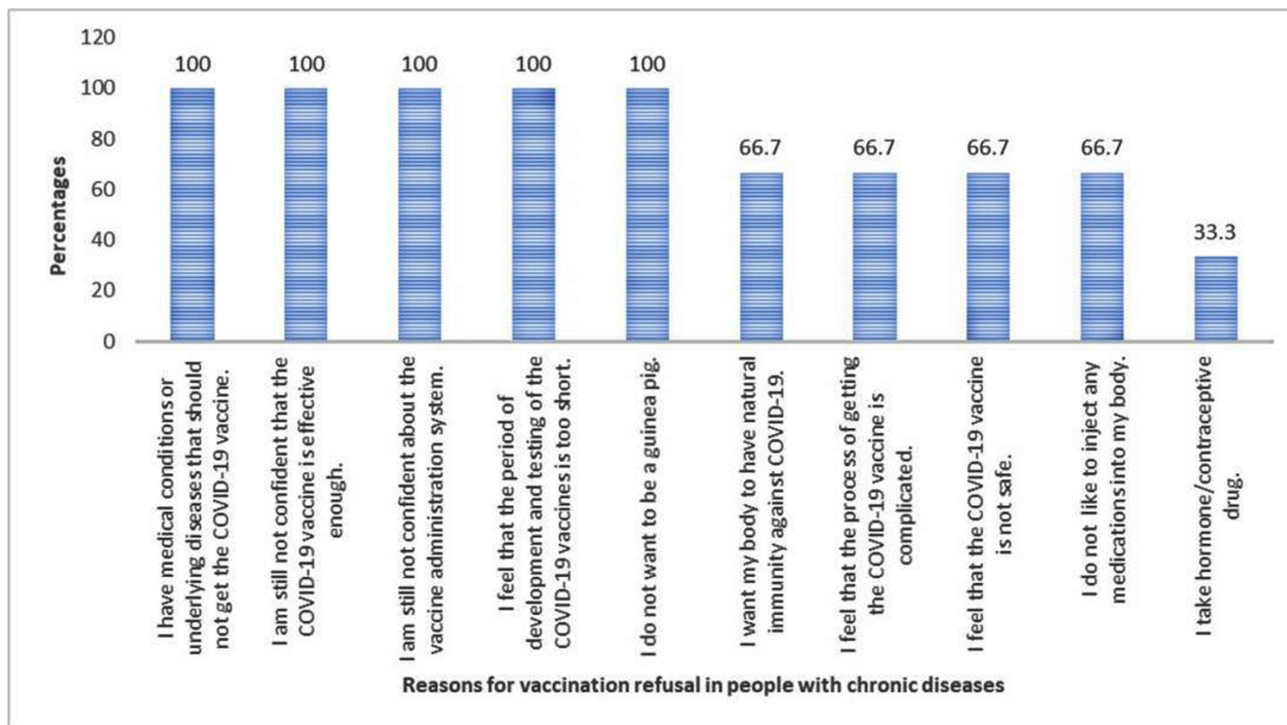


Figure 3 Reasons for vaccination refusal in people with chronic diseases (n=3).

identified by age nor marital status. Positive and negative attitudes also differed significantly by income, but no other sociodemographic variable was associated with attitudes toward vaccines.

Factors Predicting Participants' COVID-19 Vaccine Acceptance

Although preliminary binary logistic regression models indicated that variables including attainment of a bachelor's degree or higher, working status, adequate income, VL, and negative and positive attitudes were significantly associated with participants' acceptance of COVID-19 vaccination, only attainment of a bachelor's degree or higher, working status, lower negative attitudes, and higher positive attitudes were retained in the final multiple logistic regression model (Table 3). Participants indicating more positive attitudes toward the COVID-19 vaccination were more likely to accept

Table 2 Differences of Vaccine Literacies and Attitudes by Demographic Characteristics (N= 457)

Variables	Functional Literacy		Interactive/ Critical Literacy		Positive Attitudes		Negative Attitudes	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sex								
Males	2.73	0.77	3.23	0.52	5.87	0.93	4.17	1.27
Females	2.82	0.73	3.42	0.47	5.69	0.97	3.96	1.15
t (p-value)	1.21 (0.227)		3.90 (<0.001)		1.89 (0.059)		1.82 (0.070)	
Age								
< 60 years	2.78	0.75	3.38	0.50	5.74	0.97	4.04	1.22
≥ 60 years	2.82	0.73	3.30	0.50	5.75	0.93	4.01	1.13
t (p-value)	0.53 (0.594)		1.50 (0.135)		0.07 (0.946)		0.22 (0.830)	

(Continued)

Table 2 (Continued).

Variables	Functional Literacy		Interactive/ Critical Literacy		Positive Attitudes		Negative Attitudes	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Educational attainment								
Lower than Bachelor's degree	2.50	0.74	3.18	0.47	5.61	1.13	3.99	1.37
Bachelor's degree and higher	2.86	0.73	3.40	0.50	5.78	0.91	4.04	1.14
t (p-value)	4.19 (<0.001)		3.70 (<0.001)		1.34 (0.184)		0.30 (0.762)	
Marital status								
Single, separated, widowed	2.81	0.73	3.41	0.49	5.77	0.91	3.99	1.18
Married	2.77	0.76	3.29	0.50	5.72	1.01	4.07	1.21
t (p-value)	0.62 (0.539)		2.52 (0.120)		0.52 (0.607)		0.74 (0.458)	
Working status								
Currently working	2.79	0.74	3.43	0.48	5.74	0.95	4.00	1.16
Not working	2.79	0.75	3.27	0.50	5.75	0.98	4.06	1.22
t (p-value)	0.02 (0.985)		3.61 (<0.001)		0.17 (0.866)		0.54 (0.590)	
Income								
Adequate	2.83	0.73	3.37	0.50	5.81	0.90	4.16	1.15
Inadequate	2.61	0.76	3.25	0.47	5.49	1.17	3.46	1.23
t (p-value)	2.45 (0.015)		2.15 (0.032)		2.30 (0.024)		5.00 (<0.001)	

Table 3 Factors Associated with Acceptance of COVID-19 Vaccination (n=457)

Variables	Crude OR (95% CI)	Adjusted OR (95% CI)
Sex		
Male	1.43 (0.73–2.78)	–
Female	1.00	–
Age		
< 60 years	1.00	–
≥ 60 years	1.36 (0.67–2.75)	–
Educational attainment		
Less than Bachelor's degree	1.00	1.00
Bachelor's degree and higher	4.76 (2.58–8.81)**	4.40 (2.12–9.14)**
Marital status		
Single, separate, widowed	1.06 (0.59–1.90)	–
Married	1.00	–

(Continued)

Table 3 (Continued).

Variables	Crude OR (95% CI)	Adjusted OR (95% CI)
Working status		
Currently working	1.67 (0.92–3.04)	2.11 (1.03–4.39)*
Not currently working	1.00	1.00
Income		
Adequate	3.51 (1.78–6.55)*	–
Inadequate	1.00	–
COVID-19 vaccine literacy		
Functional vaccine literacy	1.65 (1.11–2.46)*	-
Interactive/critical vaccine literacy	3.20 (1.84–5.57)**	-
Attitudes towards COVID-19 vaccine		
Positive attitudes	2.64 (1.95–3.57)**	2.36 (1.69–3.29)**
Negative attitudes	0.40 (0.30–0.54)**	0.38 (0.27–0.55)**

Notes: * $p < 0.05$; ** $p < 0.001$; Nagelkerke R^2 of multiple logistic regression model = 0.391; Hosmer and Lemeshow test, p -value = 0.851.

Abbreviations: OR, Odds ratio; CI, Confidence interval.

the COVID-19 vaccination. Participants with lower negative attitude scores were more likely to accept the vaccination. Prior to adjusting the odds ratios in the final multiple logistic regression model, VL and income adequacy were also significant predictors of COVID-19 vaccination acceptance.

Discussion

This study aimed to assess COVID-19 vaccine acceptance and associated factors among people with chronic diseases in Thailand. We found a high COVID-19 vaccine acceptance rate of 89.1% (as a combination of the vaccinated and others who reported an intention to become vaccinated), possibly because this study was conducted amid Thailand's third pandemic wave in which the general public became more aware of the high number of COVID-19 deaths among the elderly and people with underlying chronic diseases,¹⁸ following the prioritization of this high-risk population for vaccine rollout.¹⁷ COVID-19 vaccination acceptance rates among the general population are approximately 58.5% in low and middle-income countries³² and 61%–63%^{33,55} from around the world. Systematic review and meta-analysis of studies of patients with chronic diseases from multiple countries worldwide found that the pooled COVID-19 vaccine acceptance rates were between 65% to 69%.^{33,56} Although we found a higher acceptance rate than those reported in these studies, our results were consistent with other studies in Thailand^{45,49} and the U.S.^{26,57} The acceptance rate of COVID-19 vaccination in people with chronic diseases varied widely across countries, depending on the time of survey, country, region, population, states of chronic conditions, personal beliefs, and health perceptions.^{24,55,56,58–60}

It is important for healthcare providers and policymakers to understand the reasons for people's decision to get vaccinated. In studies in Thailand,^{45,46,61} the United Kingdom,⁶² and Australia,⁶³ reasons given for COVID-19 vaccination acceptance were: (1) having medical conditions or underlying chronic diseases, (2) reducing the severity of symptoms if infected with COVID-19, and (3) herd immunity. Consistent with reports in the U.S.,⁶⁴ respondents in Australia⁶³ and China^{24,65} also gave the following reasons for vaccine hesitancy: (1) concerns regarding vaccination side effects, (2) the unknown impact to the human body, and (3) the long-term effects of vaccination. Similarly, reports from Saudi Arabia⁵⁸ and Germany⁶⁶ on COVID-19 vaccination refusal confirm our findings, with participants reporting: (1) the presence of medical conditions or underlying diseases, (2) lack of confidence in vaccine efficacy, and (3) lack of

confidence in the vaccine administrative system. Approximately 40% of people with chronic diseases, having an underlying disease such as hypertension, diabetes, heart disease, cancer, lung disease, stroke, chronic kidney disease, or obesity was considered a sufficient reason to accept the vaccine. Conversely, chronic disease was also one of the reasons given for refusal by 100% of those who rejected the vaccine, consistent with a study conducted in Chiang Mai, Thailand.³⁴

We found that people with at least one chronic disease who held higher socio-economic status as measured by higher education, and current employment, and higher positive and lower negative attitude scores were more likely to accept COVID-19 vaccination. In China, higher education has been similarly reported^{24,60} to predict acceptance of COVID-19 vaccination. These interrelated social variables offer people better chances to seek accurate health information.⁶⁷ The finding that attitudes influence vaccination acceptance is congruent with previous studies in Thailand^{45–47,49} and Southern Ethiopia.⁴¹ Although the sociodemographic variables of sex, age, marital status, and occupation were not predictive of COVID-19 vaccination acceptance by people living with chronic diseases, studies conducted in Nepal, Pakistan, India, and Bangladesh⁶⁸ found that these variables helped to predict vaccine acceptance.

The crude odds ratios in the binary logistic regression models indicated that functional and interactive/critical VL significantly influenced COVID-19 vaccination acceptance. Although they did not retain statistical significance in the fully adjusted model, functional and interactive/critical VL are important for people with a chronic disease to access, evaluate, and use vaccine information for decision-making.³⁷ A scoping review of the studies in multiple countries found that VL was needed for effective communication and helped to sustain immunization against COVID-19 and other communicable diseases.⁵⁰

People with chronic diseases who currently work may accept COVID-19 vaccination more readily because their work environment provides more opportunities to be better informed²⁴ and to make better decisions compared to those who are unemployed. People with chronic diseases are a vulnerable group, especially those with low education,⁶⁹ no current work,⁷⁰ and negative attitudes,⁶⁹ thus, they should receive greater attention from nurses and other healthcare providers to increase their knowledge of COVID-19 vaccines. People who have positive attitudes toward COVID-19 vaccination tend to accept the vaccine.^{24,49,71} This means that more people with higher education, current employment and positive attitudes are more likely to accept COVID-19 vaccines.⁴⁹ Although sex, age, marital status, and income may influence the acceptance of COVID-19 vaccination among those with chronic diseases, the impact is minimal. This may be because COVID-19 vaccinations were provided for free to everyone in the country, regardless of socio-economic status, as part of the universal health coverage policy in Thailand.⁷² For people with chronic diseases,⁷³ vaccine recommendations provided by physicians/health professionals could help to reduce vaccine hesitancy and eventually increase the uptake of COVID-19 vaccination.^{74–77} VL may be similarly associated with vaccination acceptance,⁷⁸ but the relative positive and negative attitudes of people with chronic diseases towards COVID-19 vaccination have a stronger influence on their acceptance.

Strengths and Limitations

This study was the first to explore COVID-19 vaccination acceptance and vaccine literacy among Thai people with chronic diseases. We are aware of some limitations. First, vaccination acceptance reported by the participants may be prone to social desirability bias; however, we used anonymous online data collection to reduce this bias. Second, older adults and those with lower socio-economic status (ie, persons with less education and inadequate income) were underrepresented in the survey. Recruitment strategies used in the original survey may have omitted those who could not access the internet or who lacked familiarity with online surveys. This could limit the generalizability of the findings. Last, owing to the cross-sectional nature of this study, it cannot be used to monitor changes in vaccine behaviors over time.

Implications for Practice and Research

As a vulnerable group, people with chronic diseases should receive greater attention from nurses and other healthcare providers to increase their knowledge of COVID-19 vaccines. Healthcare providers in Thailand are an important and trusted resource,³⁴ especially for people with chronic diseases. Policymakers and healthcare providers should incorporate VL to tailor effective

interventions for people with chronic diseases, such as the design of educational programs to promote positive attitudes⁷⁹ and reduce negative attitudes toward vaccines. Such measures may help to strengthen vaccination acceptance and vaccine confidence.⁸⁰ Misinformation about the COVID-19 vaccines should be dispelled to help reduce negative attitudes. Patients should be given valid information using clear communication strategies.²⁷ Public health communications that incorporate multimedia strategies may increase public confidence in available COVID-19 vaccines. Because COVID-19 vaccination acceptance may fluctuate over time, longitudinal studies of COVID-19 vaccination acceptance and hesitancy among people with chronic diseases are needed to monitor possible changes.

Conclusion

This study showed higher education, current employment, and positive attitudes of people with chronic diseases are significant factors influencing COVID-19 vaccination acceptance in Thailand. By understanding why people with chronic diseases choose to accept COVID-19 vaccination, healthcare providers can design effective strategies to reduce negative attitudes and assist the formation of positive attitudes toward obtaining a COVID-19 vaccination.

Data Sharing Statement

Data supporting this study are available from the corresponding author.

Ethics Approval and Informed Consent

The identification numbers of COA. MURA 2021/381 and COA. MURA 2022/300 were approved by the Committee on Human Rights Related to Research Involving Human Subjects, the Faculty of Medicine Ramathibodi Hospital, Mahidol University. Informed consents were obtained online prior to data collection. This study was conducted in accordance with the guidelines of the Declaration of Helsinki.

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The authors declare no conflicts of interest in this work.

References

1. Geng J, Yu X, Bao H, et al. Chronic diseases as a predictor for severity and mortality of COVID-19: a systematic review with cumulative meta-analysis. *Front Med.* 2021;8:588013. doi:10.3389/fmed.2021.588013
2. Bennett KE, Mullooly M, O'Loughlin M, et al. Underlying conditions and risk of hospitalization, ICU admission and mortality among those with COVID-19 in Ireland: a national surveillance study. *Lancet Reg Health Eur.* 2021;5:100097. doi:10.1016/j.lanepe.2021.100097
3. Centers for Disease Control and Prevention. COVID-19 and chronic disease prevention and interventions. Available from: <https://www.cdc.gov/chronicdisease/programs-impact/pop/covid-19.htm>. Accessed Oct 20, 2023.
4. Rainer L, Bachner F, Eglau K, Ostermann H, Siebert U, Zuba M. Comorbidities and COVID-19 hospitalization, ICU admission and hospital mortality in Austria: a retrospective cohort study. *Wiener Klinische Wochenschrift.* 2022;134(23–24):23–24. doi:10.1007/s00508-022-02036-9
5. Choi W-Y. Mortality rate of patients with COVID-19 based on underlying health conditions. *Disaster Med Public Health Prep.* 2021;16(6):2480–2485. doi:10.1017/dmp.2021.139
6. Gimeno-Miguel A, Bliet-Bueno K, Poblador-Plou B, et al. Chronic diseases associated with increased likelihood of hospitalization and mortality in 68,913 COVID-19 confirmed cases in Spain: a population-based cohort study. *PLoS One.* 2021;16(11):e0259822. doi:10.1371/journal.pone.0259822
7. Grasselli G, Greco M, Zanella A, et al. Risk factors associated with mortality among patients with COVID-19 in intensive care units in Lombardy, Italy. *JAMA Intern Med.* 2020;180(10):1345–1355. doi:10.1001/jamainternmed.2020.3539
8. Ramage-Morin PL, Polsky JY. Health-related concerns and precautions during the COVID-19 pandemic: a comparison of Canadians with and without underlying health conditions. *Health Rep.* 2020;31(5):3–8. doi:10.25318/82-003-x202000500001-eng

9. Scottish Government. Excess deaths from all causes, involving and with dementia as the underlying cause: Scotland 2020-2022. Available from: <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2022/11/excess-deaths-causes-involving-dementia-underlying-cause-scotland-2020-2022/documents/excess-deaths-causes-involving-dementia-underlying-cause-scotland-2020-2022/excess-deaths-causes-involving-dementia-underlying-cause-scotland-2020-2022/govscot%3Adocument/excess-deaths-causes-involving-dementia-underlying-cause-scotland-2020-2022.pdf>. Accessed July 24, 2024.
10. Akpek M. Does COVID-19 cause hypertension? *Angiol.* 2022;73(7):682–687. doi:10.1177/00033197211053903
11. Fang L, Karakiulakis G, Roth M. Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? *Lancet Respir Med.* 2020;8(4):e21. doi:10.1016/S2213-2600(20)30116-8
12. Belani P, Schefflein J, Kihira S, et al. COVID-19 is an independent risk factor for acute ischemic stroke. *AJNR.* 2020;41(8):1361–1364. doi:10.3174/ajnr.A6650
13. Siddiqui S, Brightling CE. Pathological disease in the lung periphery after acute COVID-19. *Lancet Respir Med.* 2021;9(10):1089–1090. doi:10.1016/S2213-2600(21)00378-7
14. Kuderer NM, Choueiri TK, Shah DP, et al. Clinical impact of COVID-19 on patients with cancer (CCC19): a cohort study. *Lancet.* 2020;395(10241):1907–1918. doi:10.1016/S0140-6736(20)31187-9
15. Hamer M, Gale CR, Kivimaki M, Batty GD. Overweight, obesity, and risk of hospitalization for COVID-19: a community-based cohort study of adults in the United Kingdom. *Proc Natl Acad Sci U S A.* 2020;117(35):21011–21013. doi:10.1073/pnas.2011086117
16. Aslaner H, Aslaner HA, Gokcek MB, Benli AR, Yildiz O. The effect of chronic diseases, age, and gender on morbidity and mortality of COVID-19 infection. *Iran J Public Health.* 2021;50(4):721–727. doi:10.18502/ijph.v50i4.5996
17. Division of Strategy and Planning Office of the Permanent Secretary Ministry of Public Health. Strategy: managing the new wave of the Covid-19 epidemic ministry of public health, January, 2021. Available from: https://ddc.moph.go.th/viralpneumonia/eng/file/main/en_Thailand%20Covid-19%20plan_MOPH_2021.pdf. Accessed July 29, 2024.
18. Emergency Operations Center Department of Disease Control. Thailand situation update on 4, July 2021. Available from: <https://ddc.moph.go.th/viralpneumonia/eng/file/situation/situation-no542-040764.pdf>. Accessed July 29, 2024.
19. Emergency Operations Center Department of Disease Control. Thailand situation update on December 31, 2021. Available from: <https://ddc.moph.go.th/viralpneumonia/eng/file/situation/situation-no720-311264.pdf>. Accessed July 29, 2024.
20. Srichaiprawat T Factor associated with deaths due to coronavirus disease 2019 in Nonthaburi Province. Available from: https://www.google.com/search?q=Factor+associated+with+deaths+due+to+coronavirus+disease+2019+in+Nonthaburi+Province&dq=Factor+associated+with+deaths+due+to+coronavirus+disease+2019+in+Nonthaburi+Province&gs_lcrp=EgZjaHJvbWUyBggAEEUYOdIBCTEyNjBqMGoxNagCALACAA&sourceid=chrome&ie=UTF-8. Accessed July 19, 2024.
21. Thairachoen S, Muenrat S, Koyadun S, Saengsuwan L Risk factors for mortality of coronavirus disease 2019 patients, Surat Thani province, Thailand. Available from: <https://he05.tci-thaijo.org/index.php/WESR/article/view/1011/933>. Accessed July 29, 2024.
22. Chungsamonkool P, Suntarasamit P, Bunpotsuwan N, Parikumsil P, Makapayab P Incidence, risk factors and mortality rate in critically III COVID-19 patients with invasive mechanical ventilation in Photharam Hospital, Ratchaburi. Available from: <https://he02.tci-thaijo.org/index.php/reg45/article/view/259505/177144>. Accessed July 29, 2024.
23. Centers for Disease Control and Prevention. People with certain medical conditions. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>. Accessed October 21, 2023.
24. Jiang N, Gu P, Sun X, et al. Acceptance of COVID-19 vaccines in patients with chronic diseases: a cross-sectional study. *J Clin Nurs.* 2022;31(21–22):3286–3300. doi:10.1111/jocn.16284
25. Al-Hanawi MK, Ahmad K, Haque R, Keramat SA. Willingness to receive COVID-19 vaccination among adults with chronic disease in the Kingdom of Saudi Arabia. *J Infect Public Health.* 2021;14(10):1489–1496. doi:10.1016/j.jiph.2021.08.002
26. Rocque GB, Caston NE, Andrews C, et al. Vaccine hesitancy versus vaccine behavior in patients with chronic illness. *J Health Care Poor Underserved.* 2022;33(4):2007–2031. doi:10.1353/hpu.2022.0150
27. Rimmel C, Tuli G, Varrelman TJ, et al. COVID-19 vaccine acceptance and uptake in Bangkok, Thailand: cross-sectional online survey. *JMIR Public Health Surveill.* 2023;9:e40186. doi:10.2196/40186
28. Troiano G, Nardi A. Vaccine hesitancy in the era of COVID-19. *Public Health.* 2021;194:245–251. doi:10.1016/j.puhe.2021.02.025
29. Arce JSS, Warren SS, Meriggi NF, et al. COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. *Nat Med.* 2021;27(8):1385–1394. doi:10.1038/s41591-021-01454-y
30. World Health Organization. Coronavirus disease (COVID-19): vaccines and vaccine safety. Available from: [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-\(covid-19\)-vaccines?adgroupsurvey={adgroupsurvey}&gclid=CjwKCAiAg9urBhB_EiwAgw88mTnkoA-4hFOzq26Cbm3GKR-ClekObuXab7pkkmiG0bM9rONr4Gd8zRoCuBAQAvD_BwE](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-(covid-19)-vaccines?adgroupsurvey={adgroupsurvey}&gclid=CjwKCAiAg9urBhB_EiwAgw88mTnkoA-4hFOzq26Cbm3GKR-ClekObuXab7pkkmiG0bM9rONr4Gd8zRoCuBAQAvD_BwE). Accessed December 12, 2023.
31. Abate BB, Tilahun BD, Yayeh BM. Global COVID-19 acceptance level and its determinants: an umbrella review. *BMC Public Health.* 2024;24(5):1–16. doi:10.1186/s12889-023-17497-4
32. Patway MM, Alam MA, Bardhan M, et al. COVID-19 vaccine acceptance among low- and lower-middle-income countries: a rapid systematic review and meta-analysis. *Vaccines (Basel).* 2022;10(3):427. doi:10.3390/vaccines10030427
33. Rahbeni TA, Satapathy P, Iumalla R, et al. COVID-19 vaccine hesitancy: umbrella review of systematic reviews and meta-analysis. *JMIR Public Health Surveill.* 2024;10:e54769. doi:10.2196/54769
34. Payaprom Y, Tantipong H, Manasatchakun P, Chandeekeawchakool S, Khamchai S. COVID-19 vaccine acceptance from the perspective of people living in Northern Thailand: a mixed methods research. *Nurs J CMU.* 2022;49(2):41–54.
35. Yanto TA, Lugito NPH, Hwei LRY, Virliani C, Octavius GS. Prevalence and determinants of COVID-19 vaccine acceptance in South East Asia: a systematic review and meta-analysis of 1,166,275 respondents. *Trop Med Infect Dis.* 2022;7(11):361. doi:10.3390/tropicalmed7110361
36. Humer E, Jesser A, Plener PL, Probst T, Pieh C. Education level and COVID-19 vaccination willingness in adolescents. *Eur Child Adolesc Psychiatry.* 2023;32(3):537–539. doi:10.1007/s00787-021-01878-4
37. Lazarus JV, Ratzan SC, Palayew A, et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med.* 2021;27(2):225–228. doi:10.1038/s41591-020-1124-9

38. Boon-Itt S, Rompho N, Jiarnkamolchurn S, Skunkan Y. Interaction between age and health conditions in the intention to be vaccinated against COVID-19 in Thailand. *Hum Vaccin Immunother.* 2021;17(12):4816–4822. doi:10.1080/21645515.2021.1979378
39. Nour MO, Natto HA. COVID-19 vaccination acceptance and trust among adults in Makkah, Saudi Arabia: a cross-sectional study. *J Egypt Public Health Assoc.* 2022;97(1):17. doi:10.1186/s42506-022-00116-2
40. El-Ghitany EM, Ashour A, Omran EA, Arghaly AG, Hassaan MA, Azzam NFAE. COVID-19 vaccine acceptance rates and predictors among the Egyptian general population and healthcare workers, the intersectionality of age and other factors. *Sci Rep.* 2022;12(1):19832. doi:10.1038/s41598-022-23825-2
41. Adella GA, Abebe K, Atnafu N, et al. Knowledge, attitude, and intention to accept COVID-19 vaccine among patients with chronic diseases in Southern Ethiopia: multi-center study. *Front Public Health.* 2022;10:917925. doi:10.3389/fpubh.2022.917925
42. Liu H, Nowak GR III, Wang J, Luo Z. A national study of marital status differences in early uptake of COVID-19 vaccine among older Americans. *Geriatrics.* 2023;8(4):69. doi:10.3390/geriatrics8040069
43. Sun Y, Li B, Li N, et al. Acceptance of COVID-19 vaccine among high-risk occupations in a port city of China and multifaceted strategies for increasing vaccination coverage: a cross-sectional study. *Risk Manag Healthc Policy.* 2022;15:643–655. doi:10.2147/RMHP.S352947
44. Biasio LR, Bonaccorsi G, Lorini C, Pecorelli S. Assessing COVID-19 vaccine literacy: a preliminary online survey. *Hum Vaccin Immunother.* 2021;17(5):1304–1312. doi:10.1080/21645515.2020.1829315
45. Kittipimpanon K, Maneesriwongul W, Butsing N, Visudtibhan PJ, Leelacharas S. COVID-19 vaccine literacy, attitudes, and vaccination intention against COVID-19 among Thai older adults. *Patient Prefer Adherence.* 2022;16:2365–2374. doi:10.2147/PPA.S376311
46. Maneesriwongul W, Butsing N, Deesamer S. Parental hesitancy on COVID-19 vaccination for children under five years in Thailand: role of attitudes and vaccine literacy. *Patient Prefer Adherence.* 2023;17:615–628. doi:10.2147/PPA.S399414
47. Maneesriwongul W, Deesamer S, Butsing N. Parental vaccine literacy: attitudes towards the COVID-19 vaccines and intention to vaccinate their children aged 5–11 years against COVID-19 in Thailand. *Vaccines.* 2023;11(12):1804. doi:10.3390/vaccines11121804
48. Nugraheni R, Astutik WS. Knowledge, attitude, and behavior related to COVID-19 vaccine acceptance: a cross-sectional study. *JHSMR.* 2023;41(6):e2023973. doi:10.31584/jhsmr.2023973
49. Butsing N, Maneesriwongul W, Visudtibhan PJ, Leelacharas S, Kittipimpanon K. COVID-19 vaccine acceptance and hesitancy among nurses in Thailand: implications, challenges, and future prospects for attitudes and vaccine literacy. *Vaccines.* 2024;12(2):142. doi:10.3390/vaccines12020142
50. Biasio LR, Zanobini P, Lorini C, et al. COVID-19 vaccine literacy: a scoping review. *Hum Vaccin Immunother.* 2023;19(1):2176083. doi:10.1080/21645515.2023.2176083
51. Bujang MA, Sa'at N, Sidik TMITABS, Joo LC. Sample size guidelines for logistic regression from observational studies with large population: emphasis on the accuracy between statistics and parameters based on real life clinical data. *Malays J Med Sci.* 2018;25(4):122–130. doi:10.21315/mjms2018.25.4.12
52. Maneesriwongul W, Butsing N, Janepanish Visudtibhan P, Leelacharas S, Kittipimpanon K. Translation and psychometric testing of the Thai COVID-19 vaccine literacy scale. *Pacific Rim Int J Nur Res.* 2022;26(1):175–186.
53. Hosmer DW, Lemeshow S. *Applied Logistic Regression.* 2nd ed ed. New York: John Wiley & Sons; 2000.
54. IBM Corp Released 2021. IBM SPSS statistics for windows, version 28.0. IBM Corp; 2021.
55. Norhayati MN, Yusof RC, Azman YM. Systematic review and meta-analysis of COVID-19 vaccination acceptance. *Front Med.* 2022;8:783982. doi:10.3389/fmed.2021.783982
56. Zhao Y, Du J, Li Z, et al. It is time to improve the acceptance of COVID-19 vaccines among people with chronic diseases: a systematic review and meta-analysis. *J Med Virol.* 2023;95(2):e28509. doi:10.1002/jmv.28509
57. Serper M, Reddy KR, Bewtra M, Ahmad N, Mehta SJ. COVID-19 vaccine perceptions among patients with chronic disease in a large gastroenterology and hepatology practice. *Am J Gastroenterol.* 2021;116(6):1345–1349. doi:10.14309/ajg.0000000000001270
58. Alghamdi AA, Aldosari MS, Alsaed RA. Acceptance and barriers of COVID-19 vaccination among people with chronic diseases in Saudi Arabia. *J Infect Dev Ctries.* 2021;15(11):1646–1652. doi:10.3855/jidc.15063
59. Hong J, Xu X-W, Yang J, et al. Knowledge about attitude and acceptance towards, and predictors of intention to receive the COVID-19 vaccine among cancer patients in Eastern China: a cross-sectional survey. *J Integr Med.* 2022;20(1):34–44. doi:10.1016/j.joim.2021.10.004
60. Wang J, Yuan B, Lu X, et al. Willingness to accept COVID-19 vaccine among the elderly and the chronic disease population in China. *Hum Vaccin Immunother.* 2021;17(12):4873–4888. doi:10.1080/21645515.2021.2009290
61. Intawong K, Chariyalertsak S, Chalom K, et al. Reduction in severity and mortality in COVID-19 patients owing to heterologous third and fourth-dose vaccines during the periods of delta and omicron predominance in Thailand. *Int J Infect Dis.* 2023;126:31–38. doi:10.1016/j.ijid.2022.11.006
62. Pfattheicher S, Petersen MB, Böhm R. Information about herd immunity through vaccination and empathy promote COVID-19 vaccination intentions. *Health Psychol.* 2022;41(2):85–93. doi:10.1037/hea0001096
63. Choi T, Chan B, Grech L, et al. Factors influencing COVID-19 vaccine hesitancy among patients with serious chronic illnesses during the initial Australian vaccine rollout: a multi-centre qualitative analysis using the health belief model. *Vaccines (Basel).* 2023;11(2):239. doi:10.3390/vaccines11020239
64. Warren AM, Perrin PB, Elliott TR, Powers MB. Reasons for COVID-19 vaccine hesitancy in individuals with chronic health conditions. *Health Sci Rep.* 2022;5(2):e485. doi:10.1002/hsr.2.485
65. Sun Y, Li X, Guo D. COVID-19 vaccine hesitancy in China: an analysis of reasons through mixed methods. *Vaccines.* 2023;11(3):712. doi:10.3390/vaccines11030712
66. Fieselmann J, Annac K, Erdsiek F, Yilmaz-Aslan Y, Brzoska P. What are the reasons for refusing a COVID-19 vaccine? A qualitative analysis of social media in Germany. *BMC Public Health.* 2022;22(1):846. doi:10.1186/s12889-022-13265-y
67. McMaughan DJ, Oloruntoba O, Smith ML. Socioeconomic status and access to healthcare: interrelated drivers for healthy aging. *Front Public Health.* 2020;8:231. doi:10.3389/fpubh.2020.00231
68. Hawlader MDH, Rahman ML, Nazir A, et al. COVID-19 vaccine acceptance in South Asia: a multi-country study. *Int J Infect Dis.* 2022;114:1–10. doi:10.1016/j.ijid.2021.09.056
69. Cascini F, Pantovic A, Al-Ajlouni Y, Failla G, Ricciardi W. Attitudes, acceptance and hesitancy among the general population worldwide to receive the COVID-19 vaccines and their contributing factors: a systematic review. *EClinicalMedicine.* 2021;40:101113. doi:10.1016/j.eclinm.2021.101113

70. Marzo RR, Sami W, Alam MZ, et al. Hesitancy in COVID-19 vaccine uptake and its associated factors among the general adult population: a cross-sectional study in six Southeast Asian countries. *Trop Med Health*. 2022;50(1):4. doi:10.1186/s41182-021-00393-1
71. Rad RE, Kahnouji K, Mohseni S, et al. Predicting the COVID-19 vaccine receive intention based on the theory of reasoned action in the South of Iran. *BMC Public Health*. 2022;22(1):229. doi:10.1186/s12889-022-12517-1
72. Tangcharoensathien V, Sachdev S, Viriyathorn S, et al. Universal access to comprehensive COVID-19 services for everyone in Thailand. *BMJ Glob Health*. 2022;7(6):e009281. doi:10.1136/bmjgh-2022-009281
73. Boziki M, Styliadis C, Bakirtzis C, et al. A national representative, cross-sectional study by the Hellenic Academy of NeuroImmunology (HEL.A. NI.) on COVID-19 and multiple sclerosis: overall impact and willingness toward vaccination. *Front Neurol*. 2021;25(12):757038. doi:10.3389/fneur.2021.757038
74. Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 vaccine: a survey of U.S. adults. *Ann Intern Med*. 2020;173(12):964–973. doi:10.7326/M20-3569
75. Liu R, Zhange Y, Nicholas S, Leng A, Maitland E, Wang J. COVID-19 vaccination willingness among Chinese adults under the free vaccination policy. *Vaccines*. 2021;9(3):292. doi:10.3390/vaccines9030292
76. Miraglia Del Giudice G, Folcarelli L, Della Polla G, Napoli A, Angelillo IF. Investigating the reasons for receiving the second booster dose of the COVID-19 vaccine in adults and in people with chronic medical conditions in Southern Italy. *Vaccines*. 2023;11(4):737. doi:10.3390/vaccines11040737
77. Sansone V, Miraglia Del Giudice G, Della Polla G, Angelillo IF. Knowledge, attitudes, and coverage of recommended vaccinations in individuals with chronic medical conditions: a cross-sectional telephone survey in Italy. *Vaccines*. 2024;12(3):336. doi:10.3390/vaccines12030336
78. Fenta ET, Tiruneh MG, Delie AM, et al. Health literacy and COVID-19 vaccine acceptance worldwide: a systemic review. *SAGE Open Med*. 2023;11:20503121231197869. doi:10.1177/20503121231197869
79. Takagi MA, Hess S, Smith Z, et al. The impact of educational interventions on COVID-19 and vaccination attitudes among patients in Michigan: a prospective study. *Front Public Health*. 2023;11:1144659. doi:10.3389/fpubh.2023.1144659
80. Murmann M, Reed AC, Scott M, et al. Exploring COVID-19 education to support vaccine confidence amongst the general adult population with special considerations for healthcare and long-term care staff: a scoping review. *Campbell Syst Rev*. 2023;19(3):e1352. doi:10.1002/cl.1352

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