



Knowledge, Attitude, Practice and Acceptance of COVID-19 Vaccine among Elderly in Chiang Mai, Thailand

ARTICLE INFO

Article Type

Descriptive Study

Authors

Jukkrit W.*¹ PhD,
Nattapong A.² MPH,
Nuttida K.¹ BSc

How to cite this article

Jukkrit W, Nattapong A, Nuttida K. Knowledge, Attitude, Practice and Acceptance of COVID-19 Vaccine among Elderly in Chiang Mai, Thailand. Journal of Education and Community Health. 2021;8(4):245-251.

ABSTRACT

Aims This study determined the knowledge, attitudes, and practices regarding COVID-19 and assessed the acceptance of the COVID-19 vaccine among the elderly in Chiang Mai, Thailand.

Instrument & Methods From February to May 2021, a cross-sectional study was conducted among 450 elderly 60 years old and above who lived in Chiang Mai Municipality. The questionnaire collected demographic characteristics, knowledge, attitude, practice about COVID-19, and acceptance of the COVID-19 vaccine. Descriptive statistics are used to analyze.

Findings The results showed that 48.4% of the participants were male, 51.6% were female, and the mean±SD age was 68.2±7.3 years. Participants have sufficient knowledge, attitude, and practice about COVID-19, and the mean±SD score is 9.7±1.3, 4.2±0.8, and 3.98±0.5, respectively. The mean±SD score of the knowledge, attitude, and acceptance of the COVID-19 vaccine were 4.3±1.4, 2.9±1.9, and 2.2±0.9, respectively. This study's major issue is 95.1% of people strongly agree that maintaining social distancing can protect them and their families from contracting COVID-19, and 92.7% strictly follow the guidelines to prevent the spread of COVID-19. The policy can ultimately control the disease. 81.3% of respondents acknowledged vaccines are vital to the health of the elderly and believe that vaccination can reduce morbidity and mortality. Also, 75.8% of people know that the COVID-19 vaccine can cause side effects.

Conclusions The elderly in Chiang Mai, Thailand, have adequate knowledge and awareness about COVID-19 and are generally optimistic about resolving the pandemic and addressing the public concerns, raising awareness about COVID-19 vaccination as a disease-control method to prevent further deterioration of general public health due to COVID-19.

Keywords COVID-19-prevention and Control; Attitude; Aged; Knowledge; Vaccine; Acceptance

¹Department of Public Health, Faculty of Public Health, Chiang Mai University, Chiang Mai, Thailand

²Doi Saket Hospital, Chiang Mai, Thailand

*Correspondence

Address: Department of Public Health, Faculty of Public Health, Chiang Mai University, Chiang Mai, Thailand. Postal Code: 50200.

Phone: +66 (81) 5959638

Fax: +66 (53) 5394252

jukkrit.w@cmu.ac.th

Article History

Received: August 21, 2021

Accepted: October 18, 2021

ePublished: December 31, 2021

CITATION LINKS

[1] Acceptability of a COVID-19 vaccine among healthcare workers ... [2] Clinical characteristics of coronavirus disease 2019 ... [3] An online survey of the attitude and willingness ... [4] An investigation of transmission control measures ... [5] Factors influencing COVID-19 vaccination uptake ... [6] COVID-19 vaccine and the herd immunity plan ... [7] Intention to vaccinate against COVID-19 in ... [8] Knowledge, attitude, and acceptance of healthcare ... [9] Acceptance of a COVID-19 vaccine in Japan during ... [10] Public knowledge, attitudes and practices towards ... [11] Knowledge, attitudes, and practices towards ... [12] Knowledge, attitudes, and preventive behaviors ... [13] Knowledge, attitude and practice toward COVID-19 ... [14] Adapting to the culture of 'new normal': an ... [15] The COVID-19 pandemic: public knowledge ... [16] A global survey of potential acceptance ... [17] Determinants of COVID-19 Vaccine acceptance ... [18] COVID-19 vaccine hesitancy: Race ... [19] Hesitant or not? the association of age ... [20] Vaccine confidence in the time of ... [21] Restoring confidence in vaccines in the COVID-19 ... [22] New realization of disaster risk reduction education ... [23] Public awareness about coronavirus vaccine ... [24] Acceptance of COVID-19 vaccine and determinant ... [25] Knowledge, acceptance and perception on COVID-19 ... [26] Attitudes towards COVID-19 vaccination, vaccine hesitancy ...

Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has brought severe disruption and unprecedented challenges to health systems worldwide. As the spread of COVID-19 has affected all aspects of life worldwide, the global humanitarian is experiencing a major global disaster [1]. COVID-19 mainly affects the respiratory system, ranging from mild rhinorrhea to severe respiratory distress syndrome. The virus is usually fatal to older adults with a history of comorbidities, such as hypertension, obesity, diabetes, and renal disease [2]. During the COVID-19 pandemic, governments have taken several strong actions to prevent and control it, including city lockdowns, travel bans, quarantine, masks, and social distancing policies [3,4]. However, it is recognized that such preventive measures may not be enough to stop the spread of COVID-19. Therefore, vaccines' development and deployment are among the most promising strategies to reduce the spread of COVID-19 [1,3-5].

For decades, the best way to control the rapid spread of infectious diseases has been vaccination. The development and provision of a COVID-19 vaccine is an ongoing process. The COVID-19 vaccine is finally available, and many countries, including Thailand, are already stocking the long-awaited vaccine [1]. After Thailand's Food and Drug Administration [6] approves the vaccines for Sinovac and AstraZeneca, it plans to roll out the vaccines in the country in phases. Early vaccinations were arranged for health care workers, the elderly, and patients with chronic and autoimmune diseases [1,6,7]. COVID-19 poses a special risk to the elderly [1,7]. Therefore, the Minister of Health of Thailand recommended encouraging everyone over 60 to get the COVID-19 vaccine. According to the recommendations of the Ministry of Health, vaccination is provided free, and a nationwide campaign has been launched to encourage every citizen to receive the vaccination. Understanding the factors that affect vaccination to better target future advertising initiatives and government interventions. The effectiveness of the vaccination program depends on widespread acceptance; this is the case even with extremely effective vaccines. However, the success of any vaccination plan depends on the high acceptance of the vaccine. The major challenge now is to build public confidence in the emergency release of the vaccine. Without this confidence, the hesitation on vaccines is inherent [7], and spreading rumors and fake news may affect the public's mentality and decision-making on vaccines [8]. This makes it necessary for us to understand the factors that affect individual acceptance or non-acceptance of vaccines to effectively formulate and implement public health pandemic strategies [5].

Therefore, to formulate policy plans and evaluate resources to meet COVID-19 and general health issues to reduce the burden of an acute pandemic, it

is important to establish the acceptance and hesitation of vaccines by the elderly. This research aimed to determine knowledge, attitudes, and practices related to the COVID-19 pandemic. We also examined the general population and healthcare providers' knowledge, attitudes, and acceptance of the COVID-19 vaccine.

Instrument and Methods

This is a cross-sectional study conducted from February to May 2021. The research participants were 60 years old and above and lived in Chiang Mai Municipality, Chiang Mai Province; of 33,433 people reported in April 2021, the sample size was calculated using a proportional estimation formula.

$$n = \frac{Z^2 \alpha / 2 \times N \pi (1-\pi)}{Z^2 \alpha / 2 \times \pi (1-\pi) + (N-1)d^2}$$

N=the elderly population in Chiang Mai province=33,433; $Z\alpha/2$ =the statistic for a level of confidence=1.96; π =the proportion of elderly Japanese who received the COVID-19 vaccine=0.62 according to a study by Masaki Machida *et al.* [9]; d=the margin of error=0.05.

The calculated sample size is 358; an incomplete questionnaire may be received because the data is collected through questionnaires and answered voluntarily. Therefore, the researchers increased the data collection by 25%; 450 samples must be collected. Multi-stage cluster sampling was conducted by randomly selecting the study villages using a simple random sampling method in 5 sub-districts. Using a simple random sampling method, ten villages were randomly assigned to 45 village elders using the simple random sampling method with a non-replaceable labeling method. The researcher asked the village health volunteers to go to the sample's home to collect the data individually. The inclusion criteria are that old aged 60 and above who lived in the district of Chiang Mai Municipality, Chiang Mai Province for no less than one year, voler adultuntarily participate in the research project, voluntarily know and sign the consent form for participating in the research project, and fully consciously be able to help themselves. The exclusion criteria are the elderly engaged in missionary work or unavailable during data collection, uncomfortable or unwilling to provide information or answer surveys, and sickness.

The questionnaire was developed based on recent literature reviews and prior research [8]. The questionnaire comprises three sections. The first section collects demographic information of the participants. The second section collects information about the knowledge, attitudes, and practices of the COVID-19 pandemic. Example items include "The major symptoms of COVID-19 are fever, weakness, dry cough, and body aches" (knowledge) "You believe

you are not at risk of COVID-19 because your immunity is strong, and they need to follow no precautionary measures (attitude) and "Every time you leave or go out publicly, routinely wear a face mask" (practice). The third section collects information about the knowledge, attitudes, and acceptance of the COVID-19 vaccine. Example items include "Being vaccinated against COVID-19 can reduce the morbidity and mortality rates of individuals" (knowledge), "Governments and related organizations are trying to find the most effective vaccine available to people" (attitude), and "you were accepted if a COVID-19 vaccine is available with an efficacy of over 80%" (acceptance). In each section of the survey, a 70% or higher score was considered sufficient knowledge, attitude, practice, and acceptance [8]. After reviewing three public health experts, this questionnaire was improved to ensure content validity. The content validity index (CVI) was 0.82 and content validity ratio (CVR)=1.0. According to the Alpha Cronbach's coefficient value of 0.86, the reliability of each scale construct was evaluated.

The data were cleaned, checked for completeness, all data were analyzed using STATA V.16 software. The data were analyzed using descriptive statistics, including frequency, percentage, mean, and standard deviation. In the case of incomplete questionnaires, we excluded (n=3) and went back to the village to collect data until completion according to the missing number.

Findings

The final analysis included 450 respondents, including 218 males (48.4%) and 232 females (51.6%). The mean±SD age was 68.2±97.3 years old, ranging from 60 to 88. More than half of the respondents (342 people, 76.0%) were married, and most (424 people, 94.2%) have received secondary education. Regarding financial status, the income of 201 (44.7%) was between 5,001-10,000 Baht. More than half of the respondents (312 people, 69.3%) had financial difficulties. Most respondents received COVID-19 pandemic and COVID-19 vaccine information from rural health volunteers (118 people, 26.2%) and health care providers (102 people, 22.7%).

Respondents have sufficient knowledge of COVID-19, and the mean±SD score was 9.7±1.3. Among the participants, 415 (98.2%) knew that the coronavirus was spread through respiratory droplets of infected persons, 392 (87.1%) believed that wearing a mask was a way to prevent the spread of COVID-19, and 378 (84.0%) believed that people who have been in contact with COVID-19 patients and high-risk groups must be quarantined in appropriate places for at least 14 days (Table 1).

The attitude means the score was 4.2±0.8. Regarding attitude, 428 people (95.1%) strongly agreed that maintaining social distancing can protect them and their families from contracting COVID-19. Four hundred seventeen (92.7%) believe that strict adherence to the guidelines for preventing the spread of COVID-19 can ultimately control the disease. Most participants, 309 (68.7%), believed that herbal medicine could protect them from COVID-19. More than half of 264 (58.7%) believe that local government policies will help reduce the spread of COVID-19, and only 9 (2.0%) believe that they are not at risk of contracting COVID-19 because of their strong immunity and no precautionary (Table 2).

The practice mean±SD score was 3.9±0.5. Respondents understand the practical preventive measures for COVID-19. Four hundred eighteen people (92.9%) said they would wear a mask every time they went out, 409 people (90.9%) said they strictly maintained social distancing, and 311 people (69.2%) knew to wash their hands with soap, alcohol, or alcohol gel. Most of the 286 people (63.6%) change their masks every day after returning home and properly dispose of the used masks. Two hundred seventy-seven people (61.6%) avoid going to crowded places (Table 3).

Overall, the mean±SD scores of knowledge, attitude, and acceptance were 4.3±1.4, 2.9±1.9, and 2.2±0.9, respectively. Respondents acknowledged vaccines were vital to the health of the elderly, and 366 people (81.3%) believe that vaccination can reduce morbidity and mortality. Also, 341 (75.8%) knew that the COVID-19 vaccine would cause some side effects, such as fever and body pain, but it was considered normal and harmless. Most participants, 309 (68.7%), believed that the COVID-19 vaccine would help build herd immunity and reduce the burden of the COVID-19 pandemic. In comparison, 286 (63.6%) believed that COVID-19 vaccination requires at least two injections at 21-30 days intervals or as recommended by a doctor (Table 4). Regarding attitudes, 286 (63.6%) governments and related agencies are working hard to find the most effective vaccines available to people, and 297 (66.0%) believe that effective vaccines will be suitable for everyone. Most participants, 321 (71.3%), believed that the benefits of vaccines usually outweigh the risks, while only 233 (51.8%) were willing to pay for alternative vaccines themselves (Table 5).

Regarding the acceptance and efficacy of the vaccine, 450 (100.0%) reported willingness to take the vaccine with 80% or higher efficacy, 236 (52.4%) with 50-70% efficacy, and 132 (29.3%) with an efficacy recommendation of the related organization (Table 6).

Table 1) Knowledge regarding the COVID-19 pandemic

Questions	Yes	No	Don't know
	N (%)	N (%)	N (%)
The major symptoms of COVID-19 are fever, weakness, dry cough, and body aches.	281 (62.5)	120 (26.6)	49 (10.9)
Nasal congestion, runny nose, and sneezing are rare in people infected with COVID-19. These symptoms differ from the common cold.	274 (60.9)	68 (15.1)	108 (24.0)
Favipiravir is the drug used to treat COVID-19 that is currently being used in Thailand.	141 (31.3)	153 (34.0)	156 (34.7)
Elderly/chronic and obese people are prone to severe symptoms of infection.	302 (67.1)	95 (21.1)	53 (11.8)
Eating with a COVID-19 patient with a separate spoon can reduce the spread of the disease.	118 (26.2)	125 (27.8)	207 (46.0)
People infected with COVID-19, if they have no symptoms, cannot spread the infection to others.	64 (14.2)	314 (69.8)	72 (16.0)
The coronavirus is spread through respiratory droplets from an infected person.	415 (98.2)	31 (6.9)	4 (0.9)
Talking to an infected person with no social distancing is highly likely to contract COVID-19.	357 (79.3)	83 (18.4)	10 (2.3)
Hand-washing with alcohol gel and social distancing when going outside helps to reduce the chance of contracting COVID-19.	366 (81.3)	49 (10.9)	35 (7.6)
Wearing a facemask is a way to prevent the spread of COVID-19.	392 (87.1)	51 (11.3)	7 (1.6)
People who have been in contact with COVID-19 patients and those at high risk must be quarantined in an appropriate place for at least 14 days.	378 (84.0)	45 (10.0)	27 (6.0)

Table 2) Attitude regarding the COVID-19 pandemic

Questions	Agree	Disagree	Not sure
	N (%)	N (%)	N (%)
You believe you are not at risk of COVID-19 because your immunity is strong, and they need to follow no preventive measures.	9 (2.0)	416 (92.4)	25 (5.6)
You believe that the traditional remedies (i.e., herbs) can protect you against COVID-19.	309 (68.7)	38 (8.4)	103 (22.9)
You agree that social distancing can protect you and your family from contracting COVID-19.	428 (95.1)	6 (1.3)	16 (3.6)
If people strictly follow the guidelines for preventing the spread of COVID-19 will eventually be able to control the disease.	417 (92.7)	12 (2.7)	21 (4.6)
Thailand will control the COVID-19 and overcome this crisis.	264 (58.7)	72 (16.0)	114 (25.3)

Table 3) Practice regarding the COVID-19 pandemic

Questions	Practice	Sometime	Not Practice
	N (%)	N (%)	N (%)
Every time you leave or go out publicly, routinely wear a face mask.	418 (92.9)	22 (4.9)	10 (2.2)
You change your face mask every day after you get home and dispose of your used mask properly.	286 (63.6)	137 (30.4)	27 (6.0)
Wash your hands regularly with soap, alcohol, or alcohol gel.	311 (69.2)	126 (28.0)	8 (1.8)
You strictly maintained social distancing.	409 (90.9)	32 (7.1)	9 (2.0)
You avoid going to crowded places, and there are many people	277 (61.6)	154 (34.2)	19 (4.2)

Table 4) Knowledge regarding the COVID-19 vaccine

Questions	Yes	No	Don't know
	N (%)	N (%)	N (%)
Being vaccinated against COVID-19 can reduce individuals' morbidity and mortality rates.	366 (81.3)	15 (3.3)	69 (15.4)
COVID-19 vaccines are important for the health of the elderly.	387 (86.0)	43 (9.6)	20 (4.4)
COVID-19 vaccination will help build herd immunity and reduce the burden of the COVID-19 pandemic.	309 (68.7)	114 (25.3)	27 (3.0)
The COVID-19 vaccine can cause side effects like fever and body pains, but it is considered normal and harmless.	341 (75.8)	72 (16.0)	37 (8.2)
The COVID-19 vaccination requires at least two injections, 21-30 days apart or as recommended by a doctor.	286 (63.6)	124 (27.6)	40 (8.8)

Table 5) Attitude regarding the COVID-19 vaccine

Questions	Agree	Disagree	Not sure
	N (%)	N (%)	N (%)
Governments and related organizations are trying to find the most effective vaccine available.	286 (63.6)	69 (15.3)	95 (21.1)
An effective vaccine will be available to all people.	297 (66.0)	81 (18.0)	72 (16.0)
The benefits of vaccines usually outweigh the risks.	321 (71.3)	47 (10.4)	82 (18.3)
You are willing to pay for alternative vaccines yourself.	233 (51.8)	182 (40.4)	35 (7.8)

Table 6) Acceptance regarding the COVID-19 vaccine

Questions	Accepted	Not Accepted
	N (%)	N (%)
Accepted if a COVID-19 vaccine is available with an efficacy of over 80%.	450 (100.0)	0.00 (00.0)
Accepted if a COVID-19 vaccine is available with an efficacy of 50-80%.	236 (52.4)	214 (47.6)
Accepted if a COVID-19 vaccine is available with the desired efficacy as a recommendation of the related organization.	132 (29.3)	318 (70.7)
You are having concern about possible severe complications from the vaccine.	317 (70.4)	133 (29.6)

Discussion

This study found sufficient knowledge, attitude, and acceptance of the COVID-19 pandemic and the COVID-19 vaccine. For knowledge about the COVID-19 pandemic and vaccines, the average scores are 9.7±1.3 and 4.26±1.4, which is a high level. Because of the difficult situation of the epidemic, news reports about this public health emergency are overwhelming. This group of people will actively learn about this infectious disease through various information channels, such as the Center for COVID-19 Situation Administration of Thailand, which has provided information in all channels, including community information provided by community leaders or national policies from the Ministry of Public Health. Consistent with the number of studies conducted in several countries, by correctly answering over 70.00% [8,10,11] of the questions, they have high knowledge about the COVID-19 disease and vaccines. However, when considering each item, a few correct answers were Favipiravir, a drug used to treat COVID-19 in Thailand. Eating with COVID-19 patients with a separate spoon can reduce the spread of the disease. If people are not aware of these issues, they may affect the behavior of preventing infection with the COVID-19 virus and even lead to epidemics. Therefore, these issues should be emphasized in public education campaigns [12].

In terms of attitudes towards the COVID-19 pandemic and vaccines, we found that our study participants believe that strict adherence to the guidelines for preventing the spread of COVID-19 can ultimately control the disease, and keeping social distance can protect them and their families from contracting COVID-19. Most participants reported that the benefits of vaccines usually outweigh the risks, and they believe that the government and related organizations are working hard to find the most effective vaccine for people to use. Interestingly, when Thailand faces a vaccine adequacy problem, our research shows that 66.00% of participants reported that the government would provide effective vaccines for everyone. This may be because the CDC provides information covering all aspects to the public every day and emphasizes people's confidence in the government's efforts to control the spread of the COVID-19 virus, thus making people have a positive attitude towards the spread of the coronavirus disease COVID-19 [12]. This is an excellent demonstration of the positive attitude of the people across the country towards COVID-19 and vaccines

because it will encourage them to face this terrible crisis.

Regarding the practice of responding to the COVID-19 pandemic and vaccines, our research found that most participants must wear a mask every time they leave home. They strictly maintain social distancing and avoid crowded places. This may be because the participants' high understanding of COVID-19 translates into safe practices [13] and the Thai health authorities' provision of educational and promotional materials to increase the public's knowledge of the disease and influence behavioral change. Our results are consistent with the "New Normal" approach that the Thai government has advocated during the COVID-19 outbreak. The new normal refers to a new way of life that differs from the past. Because of some factors affecting the patterns and practices that people are usually familiar with and expected in society, we must change it to a new way under the unfamiliar standard [14]. This campaign worked very well. People understand why they need to change their behavior and keep practicing until it becomes a habit. Consistent with a study by Zhong et al. [11], Chinese people use practice to prevent COVID-19 virus infection, thereby effectively controlling and preventing the spread of the disease. Moreover, findings were consistent with Araban et al. [15] reported that Iranian were concerned about the dangers of the virus, and about 60% or more practice safety measures.

Acceptance of COVID-19 vaccination. All study participants (100.0%) were willing to receive the COVID-19 vaccine with an efficacy of 80% or higher, and 52.4% were willing to receive a 50-80% vaccine. We also found that 70.4% of people are worried about serious complications that the vaccine may cause. Other studies on the acceptance of the COVID-19 vaccine found that the acceptance of the vaccine varies from country to country. About 90%, 64%, 60%, and 55% of the potential public accept the vaccine in China, Saudi Arabia, Libya, and Russia, respectively [8]. However, in Kuwait (23.6%) and Jordan [16,17], the acceptance rate is lower, at 23.6% and 28.4%. This may be because of many factors that make people fear and distrust vaccines [18]. To reduce this hesitation and increase public trust, it is necessary to strengthen the intervention of public health experts and large-scale crowd-based campaigns [17,18].

Nevertheless, Lazarus et al. [16] and Elhadi et al. [8] reported a high level of trust in government policies,

which is slightly similar to our survey results, of which 63.6% are confident in the government and healthcare providers' policies on the COVID-19 pandemic and vaccines. When people have high trust in the government. Therefore, the government and public health experts must take necessary measures to increase the acceptance and encouragement of the COVID-19 vaccine in a local cultural way [20, 21]. It is also necessary to educate the entire population to reduce the public's efforts to monitor pandemics by delaying transmission or preventing risks [22]. Finally, transparent society and educational activities that demonstrate the social benefits of vaccination are essential to mitigate the harmful effects of the pandemic [23]. COVID-19 vaccine should be promoted preferably by a centralized, trusted source of knowledge, such as religious or political authorities [24]. Healthcare practitioners should conduct ongoing public awareness campaigns about the necessity, safety, and efficacy of the COVID-19 vaccination, particularly among populations at increased risk of the disease, including older adults [24-26].

According to our findings, this is the first study conducted in Chiang Mai in the northern region of Thailand, which is still suffering from the third wave of COVID-19. Therefore, it provides valuable data for policymakers to plan vaccination programs and tackle the challenges identified in the research. The study has some limitations. Firstly, the small sample size and the research design used as a cross-sectional survey method may not draw conclusions and strong correlations; therefore, further longitudinal research is needed. Secondly, the study was only conducted in Chiang Mai Province under specific circumstances, limiting the generality of the results. The findings of this study might help direct the efforts and plans of the country's health authorities for better containment of COVID-19 and its further spread, such as the Ministry of Public Health in planning future attempts to enhance vaccination uptake, which could lead to herd immunity against COVID-19.

Conclusion

The elderly have sufficient knowledge, attitude, and practice about COVID-19 and are optimistic about the pandemic solution. It is important to address public concerns, increase awareness of the COVID-19 vaccine, reduce the hesitation of vaccination, and increase efforts to provide vaccine resources to countries to prevent COVID-19 from further deteriorating public health.

Acknowledgments: We sincerely thank all participants for spending their precious time supporting the data collection of this study. We would also like to thank the Faculty of Public Health, Chiang Mai University, for supporting our research.

Ethical Permissions: The Ethics Research Committee of the School of Public Health, Chiang Mai University (approval number: ET005/2021) approved this study.

Conflicts of Interests: The author has reported no conflict of interest.

Authors' Contribution: Jukkrit W (First Author), Introduction Writer/Main Researcher/Statistical Analyst (60%); Nattapong A (Second Author), Methodologist/Main Researcher/Statistical Analyst/Discussion Writer (35%); Nuttida K (Third Author), Assistant Researcher/Discussion Writer (25%).

Funding/Support: No funding.

References

- 1- Qattan AMN, Alshareef N, Alsharqi O, Al Rahahleh N, Chirwa GC, Al-Hanawi MK. Acceptability of a COVID-19 vaccine among healthcare workers in the Kingdom of Saudi Arabia. *Front Med.* 2021;8:644300.
- 2- Guan WY, Ni ZY, Hu Y, Liang W-h, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.* 2020;382:1708-20.
- 3- Chen M, Li Y, Chen J, Wen Z, Feng F, Zou H, et al. An online survey of the attitude and willingness of Chinese adults to receive COVID-19 vaccination. *Hum Vaccin Immunother.* 2021;17(7):2279-88.
- 4- Tian H, Liu Y, Li Y, Wu C-H, Chen B, Kraemer MU, et al. An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China. *Science.* 2020;368(6491):638-42.
- 5- Malesza M, Bozym M. Factors influencing COVID-19 vaccination uptake in an elderly sample in Poland. *MedRxiv.* 2021 Mar.
- 6- Chokkanchitchai S. COVID-19 vaccine and the herd immunity plan in Thailand. *J Prevent Med Assoc Thai.* 2021;11(1).
- 7- Rhodes A, Hoq M, Measey MA, Danchin M. Intention to vaccinate against COVID-19 in Australia. *Lancet Infect Dis.* 2021;21(5):e110.
- 8- Elhadi M, Alsoufi A, Alhadi A, Hmeida A, Alshareea E, Dokali M, et al. Knowledge, attitude, and acceptance of healthcare workers and the public regarding the COVID-19 vaccine: a cross-sectional study. *BMC Public Health.* 2021;21:955.
- 9- Machida M, Nakamura I, Kojima T, Saito R, Nakaya T, Hanibuchi T, et al. Acceptance of a COVID-19 vaccine in Japan during the COVID-19 pandemic. *Vaccines.* 2021;9(3):210.
- 10- Mohamad E, Azlan AA, Hamzah MR, Sern TJ, Ayub SH. Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PLoS One.* 2020;15(5):e0233668.
- 11- Zhong BL, Luo W, Li HM, Zhang QQ, Liu XG, Li WT, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int J Biol Sci.* 2020;16(10):1745-52.
- 12- Khumsaen N. Knowledge, attitudes, and preventive behaviors of COVID-19 among people living in Amphoe U-Thong, Suphanburi Province. *J Prachomklao Coll Nurs Phetchaburi Prov.* 2021;4(1):33-48.
- 13- Al-Hanawi MK, Angawi K, Alshareef N, Qattan AMN, Helmy HZ, Abudawood Y, et al. Knowledge, attitude and practice toward COVID-19 among the public in the kingdom of Saudi Arabia: a cross-sectional study. *Front Public Health.* 2020;8:217.
- 14- Corpuz JCG. Adapting to the culture of 'new normal': an emerging response to COVID-19. *J Public Health.* 2021;43(2):e344-45.

- 15- Araban M, Karimy M, Mesri M, Rouhani M, Armoon B, Koohestani HR, et al. The COVID-19 pandemic: public knowledge, attitudes and practices in a central of Iran. *J Educ Community Health*. 2021;8(1):35-40.
- 16- Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med*. 2021;27:225-8.
- 17- Al-Mohaithef M, Kumar Padhi B. Determinants of COVID-19 Vaccine acceptance in Saudi Arabia: A web-based national survey. *J Multidiscip Healthc*. 2020;13:1657-63.
- 18- Willis DE, Andersen JA, Bryant-Moore K, Selig JP, Long CR, Felix HC, et al. COVID-19 vaccine hesitancy: Race/ethnicity, trust, and fear. *Clin Transl Sci*. 2021.
- 19- Lazarus JV, Wyka K, Rauh L, Rabin K, Ratzan S, Gostin LO, et al. Hesitant or not? the association of age, gender, and education with potential acceptance of a COVID-19 vaccine: a country-level analysis. *J Health Commun*. 2020;25(10):799-807.
- 20- Harrison EA, Wu JW. Vaccine confidence in the time of COVID-19. *Eur J Epidemiol*. 2020;35(4):325-30.
- 21- Verger P, Dubé E. Restoring confidence in vaccines in the COVID-19 era. *Expert Rev Vaccines*. 2020;19(11):991-3.
- 22- Shaw R, Sakurai A, Oikawa Y. New realization of disaster risk reduction education in the context of a global pandemic: lessons from Japan. *Int J Disaster Risk Sci*. 2021;12:568-80.
- 23- Elgendy MO, Abdelrahim MEA. Public awareness about coronavirus vaccine, vaccine acceptance, and hesitancy. *J Med Virol*. 2021:1-9.
- 24- Berihun G, Walle Z, Berhanu L, Teshome D. Acceptance of COVID-19 vaccine and determinant factors among patients with chronic disease visiting dessie comprehensive specialized hospital, Northeastern Ethiopia. *Patient Prefer Adherence*. 2021;2021:1795-805.
- 25- Mohamed NA, Solehan HM, Mohd Rani MD, Ithnin M, Che Isahak CI. Knowledge, acceptance and perception on COVID-19 vaccine among Malaysians: A web-based survey. *PLoS One*. 2021;16(8):1-17.
- 26- Cordina M, Lauri MA, Lauri J. Attitudes towards COVID-19 vaccination, vaccine hesitancy and intention to take the vaccine. *Pharm Pract*. 2021;19(1):2317.