Intention to vaccinate against COVID-19 among Thai people, Thailand: Cross sectional online survey

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Abstract

Background: Coronavirus disease 2019 (COVID-19) has rapidly emerged as a global pandemic. Vaccine development is proceeding at an unprecedented pace. Once available, it will be important to maximize vaccine uptake and coverage to control the pandemic.

Objective: To assess intention to be vaccinated against COVID-19 among a representative sample of Thai people aged 18-60 years living in Thailand. Moreover, predictors of and reasons for vaccine hesitancy to be identified.

Design: Cross-sectional online survey between April-June 2021.

Measurements: Intention to be vaccinated against COVID-19 was measured with a question "When a vaccine for COVID-19 is ready for you, will you get vaccinated?" Response options were "yes", "not sure" and "no". Participants who responded "not sure" or "no" were asked to provide a reason.

Results: A total of 1,464 responses were received. Overall, 45.4% (n = 665) of participants intended to get vaccinated, 39.4% (n = 577) were unsure, and 15.2% (n = 222) were not planning to get vaccinated. Factors that were independently associated with vaccine hesitancy included being female, being a student, low monthly income group, and having a congenital disease. Confidence in public health care system in handling the pandemic (Exp β =0.838, p<0.01), risk perception of getting COVID-19 (Exp β =0.821, p<0.01) and confidence in government handling the pandemic (Exp β =0.794, p<0.01) were predictive factors for chance of saying "not sure" than "yes" at 83.8%, 82.1% and 79.4%, respectively.

Conclusion: 45.4% (n=665) of participants intended to be vaccinated against COVID-19. Common reasons of vaccine hesitancy or refusal were concerned over unforeseen side effects of COVID-19 vaccine and preference for more choices of COVID-19 vaccine than what was provided by the government.

Keywords: COVID-19 Vaccination, Vaccine acceptance, Vaccine hesitancy

Introduction

COVID-19 is the most recent disease being introduced to mankind since the year of 2019 until the present time. The virus originated in the city of Wuhan, China which is where the first case was reported. COVID-19 is considered a very highly contagious disease as the virus could be transmitted mostly via air. In this manner, the virus could leave the infected person the moment they breathe, sneeze, cough or talk. Moreover, the droplets could travel up to 6 feet airborne which is twice the distance of the Ebola virus

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(1) . Due to the coronavirus SARS-Cov-2, the patient that gets infected would have the following symptoms: fever, dry cough, tiredness, headache, sore throat, difficulties breathing and chest pain. The virus specifically attacks the epithelial cells located in the nasal captivity. They are able to enter the host cell via the binding of the SARS-CoV-2 spike glycoprotein and the angiotensin-converting enzyme 2 (ACE2) receptor. Eventually, the lungs would be affected by pneumonia which occurs when the tiny air sacs called alveoli get infected. Nevertheless, only about 15% of the patients experience these severe symptoms. Despite being tremendously infectious, the low death rate indicates that there is a specific range of people's ages targeted by the virus (2) . According to the statistics published by the Centers for Disease Control and Prevention (CDC), there is a direct relationship between the age and the number of people being killed by the virus. The statistics illustrate that the higher the age, the higher the chance of those people suffering from the virus. For instance, a total of 141,580 deaths were reported within the group of people whose ages are 85 and older in February 2021. This value is the highest out of all the age range. Other than ages, the other factor that could lead to death is congenital diseases. This could vary from cardiac diseases, lung diseases, kidney diseases, type 2 diabetes and cancerous diseases(3) . As mentioned earlier, the virus is airborne and would cause multiples of damages if being able to enter the body of a human. Anyhow, the general solution to this problem is to break the chain of infection. There are six major portions in the chain of infections which consist of the infectious agent, reservoir, portal of entry, mode of transmission, portal of exit and susceptible host.The development of a vaccine which aims to build immunity for people and reduce the infection rate of COVID-19 is one of the most important ways to stop the spreading of COVID-19. Additional measures are wearing masks, washing hands and social dissociation that has been incorporated around the world during th e period following its outbreak. With this urgent task, scientists around the world focused on developing a COVID-19 vaccine. 70% of the population must be vaccinated to build up herd immunity to control the pandemic, therefore, countries worldwide have developed a vaccine plan to control the COVID-19 pandemic. Nonetheless, the usage of the vaccines are still being

debated owing to the fact that they are still not able to function properly (4) . This causes certain vaccinated individuals to suffer from various side effects that could potentially lead to death. Certain brands of vaccines are now being standardised and used to eliminate the virus. For example, some of the most effective brands consist of Pfizer-BioNTech, Moderna, Johnson and Johnson's, AstraZeneca, Sinopharm, Sinovac, Sputnik V and Novavax. Out of all these brands, only Pfizer-BioNTech and Moderna are suitable for those 18 years old or younger. Others are not yet being tested among the young; therefore, it is not being recommended for those underage to be vaccinated. Moreover, AstraZeneca is believed to work best with the elders. What differentiates these vaccines are the process of developing them and the ingredients that were being included in the vaccines. For instance, Sinovac is an inactivated vaccine using beta-propiolactone of the SARS-CoV-2 virus, while AstraZeneca is formed by using a modified adenovirus. To continue, each brand requires an unequal number of doses in order for the vaccines to be fully functional. However, it has not yet been proven that any covid vaccines are 100% resistant to the virus (5) . However, as of 6 Aug 21, Thailand had 714,684 confirmed Coronavirus cases, and 5,854 deaths.(Worldometer) and the number of cases appeared to be still going up, COVID-19 vaccination is necessary in order to control the pandemic (6).

In addition, many of the efficacy, safety, long-term side effects, attitudes and beliefs towards vaccines and other related issues still remain (7,8,9,10,11,12,13,14,15,16,17,18,19,20). The COVID-19 vaccine policies and plans implemented were different for each country which in turn raised doubts or uncertainties and could lead to refusal or hesitation of getting vaccines. Ultimately, this is a significant public health problem in the control of the pandemic. Therefore, the aim of this research was to study the intention to vaccinate against COVID-19 and factors that affect thai citizens aged 18-60 to vaccinate. In order to increase the rate of COVID-19 vaccine acceptance, this age group has to be informed with health knowledge and provided with more vaccine options.

Methods

We adopted a cross-sectional online survey designed to evaluate Thai people's COVID-19 related knowledge, risk perception of getting COVID-19 and intention to be vaccinated against COVID-19. The survey was released to Thai people that can access the internet in Thailand. An invitation was sent to social media groups during 1 April-31 June 2021 with a total of 1,464 people responding to it. All participants completed surveys via Google form.

Instrument

The questionnaire was developed based on a literature review including:

(1) Information provided and a guideline from the Health Authorities (Ministry of Public Health Thailand, Center of Disease Control and World Health Organization) regarding COVID-19 and,

(2) (2) Studies in other countries have already been conducted on the same subject with a number of common items used to evaluate each dimension analysed in this study. The items then were grouped and redundant items removed.

(3) (3) all the questions were in Thai language.

A preliminary version of the instrument was reviewed by three infection control specialists to validate its content and Cronbach's alpha ($\alpha = 0.80$) also showed that it was acceptable. A pre-test of the questionnaire was done to test whether the level of language was suitable for them. All of the questions remained unchanged after this. As described under the statistical analysis section, the psychometric characteristics of the questionnaire were also tested.

The final version of the questionnaire contained 28 questions, four on the participant's personal details including gender, living arrangement, having congenital disease, receipt of influenza vaccination and the remaining 24 questions were divided into three sections.

The first section consists of 10 questions on COVID-19 related knowledge such as modes of transmission, symptoms, prevention and COVID-19 vaccine. The participants were asked to choose the correct answer out of four choices. One point was assigned to each correct answer, while an incorrect answer received

zero points. Therefore, higher scores corresponded to a higher level of knowledge.

The second section was on risk perception of getting COVID-19. This section comprised of four questions, and the response categories consisted of a five-point Likert scale (1 for very low risk, 2 for low risk, 3 for neutral, 4 for high risk, and 5 for very high risk) with the highest score corresponding to the highest awareness of risk of getting COVID-19. Possible results were between 5 to 20 points, the score was then divided for an average ranging between 1-5. Interpretation of this scale was 1 for very low risk, 2 for low risk, 3 for moderate risk, 4 for high risk, and 5 for very high risk.

The third section was on confidence in the government in handling the pandemic and in the public health care system. This section includes two questions, and the response categories consisted of a five-point Likert scale (1 for very low confidence, 2 for low confidence, 3 for neutral, 4 for high confidence, and 5 for very high confidence) with the highest score corresponding to high level of confidence in the government in handling the pandemic and in the public health care system.

The last section was on intention to be vaccinated against COVID-19. This section consists of one question: "When a vaccine for the COVID-19 is ready for you, will you get vaccinated?" Response options were "yes", "not sure" and "no". Participants who responded "not sure" or "no" were asked to provide a reason. Survey items are shown in Table 1.

Ethical consideration

This research used an anonymous data collection method to collect data via google form from Thai citizens who can access the internet. The invitation was sent to social media groups used by Thai people. In these invitations, information about the study's objectives and the ethical guarantee of confidentiality and anonymity in the data collected as stated in the informed consent was explained. Participation was completely free and voluntary, and no personal data were collected from any participants.

Statistical Analysis

Participant characteristics were summarized by using frequencies and percentages. We used crosstabulation and chi-square tests to estimate unadjusted

associations of participant characteristics with the 3-category outcome intention to get vaccinated. To better distinguish characteristics associated with responses of "not sure" versus "yes" and of "no" versus "yes", we also calculated separate chi-square tests and associated P values. Pearson's Correlation was used to test association among scale variables.

To estimate corresponding adjusted (multivariate) associations, multinomial logistic regression was used to compare each of two or more non-ordered outcome categories to the reference category. In particular, we modelled both natural log [Preference (Yes)/ Preference (Not sure)] and natural log [Preference (Yes)/ Preference (No)] as a function of participant characteristics. This approach allows different associations with covariates for the two comparisons while providing overall P values for covariates. Whereas, coefficients from a binomial logistic regression model are typically exponentiated to obtain odd ratios, exponentiated coefficients from a multinomial logistic regression model are interpreted as odd ratios. An illustrative calculation is provided in Table 3.

Characteristics that were not statistically significant (P<0.05) in the multivariate multinomial modelling were omitted in the final mode. These characteristics were found to be correlated with predictors retained in the final model (for example, the type of house participant lives in.)

Thematic analysis to inductively produce categories and distinguish topics within the responses was applied with an open-ended inquiry requesting for reasons for vaccine hesitancy. A categorising framework was made on the basis of initial review of all responses. The reasons for vaccine hesitancy were summarized in Table 4.

Results

The majority of participants were female (n= 784, 53.6%), living without any children or senior members (n=649, 46.4%). Among the participants, 80 % (n=1,171) of participants reported having no congenital disease and 60.9 % (n=892) reported living in a single house. Students revealed a moderate level of COVID-19 related knowledge with an average

score of 8.28 (SD=1.45) from a total of 10. Most participants revealed a low level of risk perception of getting COVID-19 (M=3.31, SD=1.00); a low level of confidence in the government in handling the pandemic (M=1.91, SD=1.05); and a low level of confidence in the public health care system in handling COVID-19 cases (M=2.56, SD=1.11), all from a total of 5.

The level of physical health perception among participants was considered at a moderate level. Female students showed slightly higher knowledge scores and higher risk perception of getting COVID-19 than male students. Moreover, male showed a slightly lower level of confidence in the government and in the public health care system in handling COVID-19 cases and also lower levels of physical health perception. Participants who reported living with children and /or senior members showed the highest level of knowledge about COVID-19 and the moderate level of risk perception of getting COVID-19 and the lowest level of confidence in the public health care system in handling COVID-19 cases among other groups.

Most participants showed a low level of confidence in the government handling the COVID-19 pandemic at an average score of 2.03 (SD=1.08). In addition, the participants showed quite a high level of confidence in the public health care system at an average score of 2.77 (SD=1.13). Participants who reported living in a single house had the highest level of COVID-19 related knowledge (M=8.2, SD=1.37), the lowest level of risk perception of getting COVID-19 (M=3.23, SD=1.00) and the highest level of confidence in the government in handling COVID-19 (M=1.98, SD=1.09) among other groups.

Participants without congenital disease showed higher levels of knowledge about COVID-19 (M=8.21, SD=1.43) and higher risk perception of getting COVID-19 (M=3.31, SD=0.97) than the group with congenital disease. Participants who reported having congenital disease had higher levels of confidence in the government handling COVID-19 (M=2.26, SD=1.23) and higher level of confidence in the public health care system in handling COVID-19 cases (M=3.0, SD=1.26).

Table 1. Sociodemographic Characteristics							
Gender	n	%	COVID-19 related knowledge (Range 0-10) M (SD)	Risk perception of getting COVID-19 (Range 1-5) M (SD)	Confidence in government in handling the pandemic (Range 1-5) M (SD)	Confidence in public health care system in handling the pandemic (Range 1-5) M (SD)	Self Perceived physical health condition (Range 1-5) M(SD)
Male	680	46.4	8.27 (1.45)	3.26 (.90)	1.84 (.96)	2.60 (1.05)	3.68 (.801)
Female	784	53.6	8.09 (1.46)	3.35 (1.04)	1.98 (1.3)	2.69 (1.23)	3.71 (.782)
Age							
18-29	956	65.3	8.23 (1.47)	3.37 (.93)	1.58 (.76)	2.25 (.93)	3.80 (.797)
30-49	314	21.4	8.21 (1.38)	3.22 (.99)	2.27 (1.17)	3.19 (1.16)	3.59 (.741)
50+	194	13.3	7.86 (1.48)	3.15 (1.15)	3.0 (1.2)	3.72 (1.10)	3.40 (.743)
Educational Attainment							
High school	306	20.9	8.02 (1.49)	3.14 (1.13)	1.89 (1.05)	2.61 (1.26)	3.66 (.815)
Bachelor	952	65	8.26 (1.37)	3.38 (.91)	1.81 (.97)	2.5 (1.04)	3.73 (.78)
Master & Above	206	14.1	8.17 (1.45)	3.20 (.98)	2.42 (1.30)	3.26 (1.30)	3.70 (.791)
Occupation							

Employee	265	18.1	8.17 (1.38)	3.19 (1.15)	2.33 (1.29)	3.2 (1.25)	3.65 (.775)
Business Owner	210	14.3	8.20 (1.41)	3.31 (1.00)	2.34 (1.2)	2.99 (1.23)	3.64 (.752)
Students	836	57.1	8.28 (1.45)	3.40 (.90)	1.56 (.72)	2.22 (.88)	3.80 (.802)
Others	153	10.5	7.54 (1.50)	3.00 (.95)	2.42 (1.30)	2.5 (1.19)	3.30 (.660)
Monthly Income							
Total<20,000	967	66.1	8.25 (1.42)	3.38 (.93)	1.65 (0.83)	2.31 (.95)	3.81 (.793)
20,001-40,000	228	15.6	8.01 (1.50)	3.20 (1.08)	2.25 (1.19)	3.16 (1.18)	3.50 (.742)
>40,001	269	18.3	8.05 (1.54)	3.14 (1.01)	2.56 (1.26)	3.44 (1.21)	3.50 (.751)
Living Arrangement							
Living alone	218	14.9	8.06 (1.63)	3.46 (0.93)	1.83 (1.06)	2.68 (1.10)	3.67 (.799)
Family with children and/or senior member	567	38.7	8.24 (1.43)	3.32 (1.43)	1.89 (1.08)	2.54 (1.17)	3.71 (.783)
Family without children and/or senior member	679	46.4	8.15 (1.42)	3.24 (.99)	1.96 (1.04)	2.73 (1.15)	3.70 (.796)
Type of House							
Single House	892	60.9	8.20 (1.37)	3.23 (1.00)	1.98 (1.09)	2.69 (1.18)	3.72 (.822)
Town House	307	21	8.05 (1.57)	3.41 (.95)	1.91 (1.05)	2.68 (1.16)	3.58 (.707)
Apartment or Condo	265	18.1	8.19 (1.60)	3.4 (.91)	1.68 (.92)	2.47 (1.00)	3.78 (.763)
Having Congenital							

Disease							
No	1,171	80	8.21 (1.43)	3.31 (0.97)	1.83 (.99)	2.56 (1.11)	3.79 (.778)
Yes	293	20	8.03 (1.55)	3.29 (1.02)	2.26 (1.23)	3.0 (1.26)	3.33 (.732)
Had a flu vaccine before							
Yes	902	61.6	8.21 (1.42)	3.30 (.98)	1.91 (1.05)	2.71 (1.16)	3.67 (.778)
No	562	38.4	8.11 (1.51)	3.31 (.97)	1.91 (1.07)	2.56 (1.14)	3.74 (.810)
Total	1,464	100	8.17 (1.46)	3.31 (.98)	1.91 (1.06)	2.65 (1.15)	3.7 (.79)

Overall, 45.4% (n=665) of the participants intended to be vaccinated against COVID-19, 39.4% (n=577) were not sure whether they would be vaccinated, and 15.2% (n=222) didn't intend to be vaccinated. The combined data among those who hesitated and refused vaccines was 54.6 % of all participants (n=799.) Factors associated with intention to vaccinate were age, educational attainment, occupation, monthly income, having congenital disease and whether they have had an influenza vaccine before.

COVID-19 vaccine acceptance rate of male participants was 48.23% (n=328) while female participants was 42.98% (n=337). Age groups of more than 50 's had the highest vaccine acceptance rate among other groups at 60.31% (n=117) followed by 30-49 (52.23%, n=164). Participants who graduated with a master degree and above had the highest COVID-19 vaccine acceptance rate at 50.97% (n=105) followed by bachelor degree (47.27%, n=450). Participants who worked for an organization had the highest COVID-19 vaccine acceptance rate at 51.70% (n=137) followed by group "others" (50.98%, n=78) and business owners (50.4%, n=106). Participants who earned more than 40,000 baht per month had the highest COVID-19 vaccine acceptance rate at 57.99% (n=156), followed by 20,001-40,000 groups (48.68%, n=111). Participants who reported living alone had the highest COVID-19 vaccine acceptance rate at 45.87%, n=100), followed by living with family without children aged below 12 years and/or without a senior member (45.51%, n=309). Participants who lived in a single house had the highest COVID-19 vaccine acceptance rate at 47.20% (n=421), followed by condominium / apartment group (45.28%, n=120). Participants who reported having congenital disease had a higher COVID-19 vaccine acceptance rate (53.92%, n= 158) than those who report not having one (43.30%, n= 507). Participants who reported having an influenza vaccine before had a higher COVID-19 vaccine acceptance rate (46.34%, n= 418) than one who never had one. (43.95%, n=247) Table 2

Table 2. Intent to Be Vaccinated, by Participant Characteristic				
	N	Intent to be vaccinated , n %		
		Yes (n=665, 45.4%)	Not sure (n=577, 39.4%)	No (n=222, 15.2%)
Gender				
Male	680	328 (48.23)	253 (37.21)	99 (14.56)
Female	784	337 (42.98)	324 (41.32)	123 (15.69)
Age				
18-29	956	384 (40.17)	421 (44.04)	151 (15.80)
30-49	314	164 (52.23)	103 (32.80)	47 (14.97)
50+	194	117 (60.31)	53 (27.32)	24 (12.37)
Educational Attainment				
High school	306	110 (35.94)	132 (43.14)	64 (20.92)
Bachelor	952	450 (47.27)	377 (39.60)	125 (13.13)
Master & Above	206	105 (50.97)	68 (33.01)	33 (16.02)
Occupation				
Employee	265	137 (51.70)	84 (31.70)	44 (16.60)
Business Owner	210	106 (50.4)	77 (36.67)	27 (0.1)
Students	836	344 (41.15)	362 (43.30)	130 (15.56)
Others	153	78 (50.98)	54 (35.29)	21 (13.73)
Monthly Income				
<20,000	967	398 (41.16)	429 (44.36)	140 (14.48)

20,001-40,000	228	111 (48.68)	76 (33.33)	41(17.98)
>40,000	269	156 (57.99)	72 (26.77)	41 (15.24)
Living Arrangement				
Living alone	218	100 (45.87)	90 (41.28)	28 (12.84)
Family with children and/or senior member	567	256 (45.15)	218 (38.45)	93 (16.40)
Family without children and/or senior member	679	309 (45.51)	269 (39.62)	101 (14.87)
Type of house				
Single house	892	421 (47.20)	340 (38.12)	131 (14.69)
Town house	307	124 (40.39)	128 (41.69)	55(17.92)
Condominium / Apartment	265	120 (45.28)	109 (41.13)	36 (13.58)
Had Congenital Disease				
No	1,171	507(43.30)	487 (41.59)	177 (15.12)
Yes	293	158 (53.92)	90 (30.72)	45 (15.36)
Having an influenza vaccine before				
Yes	902	418 (46.34)	350 (83.73)	134 (14.86)
No	562	247 (43.95)	227 (40.39)	88 (15.66)
Total	1,464	665 (45.4)	577 (39.4)	222 (15.2)

Factors that were independently associated with vaccine acceptance (response of "not sure" or "yes") included being male (OR= 0.758, [95% IC, 0.59-0.965]). Consequently, male participants were 0.758 times more likely to say "not sure" than female participants, in the other words, male participants would say "not sure" less than female 24.2%. Being a student (OR= 0.941, [95% IC, 0.296-0.993]) they were more likely 0.941 times to say "not sure" than participants who reported their work as "others" group, in the other words, student participants would say "not sure" less than the group "others" 5.9%. Participants who earned less than 20,000 baht per month (OR= 1.858, [95% IC, 1.100-3.139]) had a 1.858 times higher chance to say "not sure" than participants who earned more than 40,000 baht per

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month. Participants who reported having a congenital disease (OR= 1.406, [95% IC, 1.023-1.933]) had 1.406 times higher chance to say "not sure" than those who reported not having one. Confidence in public health care system in handling the pandemic (Exp β =0.838, p<0.01), risk perception of getting COVID-19 (Exp β =0.821, p<0.01) and confidence in government handling the pandemic (Exp β =0.794, p<0.01) were predictive factors for chance of saying "not sure" than yes at 83.8%, 82.1% and 79.4%, respectively, which were statistically significant.

Vaccine acceptance (response of "no" or "yes") associated factors were COVID-19 related knowledge

(Exp β=0.84, [95% IC, 0.756-0.932], p<0.01), risk perception of getting COVID-19 (Exp β=0.665, [95% IC, 0.563-0.787], p<0.01) and the level of confidence in the government handling the pandemic (Exp β=0.567, [95% IC, 0.456-0.704], p<0.01) were predictive factors and that affect the decision of saying "no" than "yes" at 84%, 66.5%, 56.7% accordingly, which also were statistically significant.

Table 3 Multivariate Predictors of Responding "Yes" V.S. "Not sure" or "No" Regarding Intent to be vaccinated, According to the Multinomial Model.

Table 3. Multivariate Predictors of Responding "Not sure" or No Regarding Intent to be vaccinated								
	Intention to be vaccinated : Not Sure vs. Yes				Intention to be vaccinated : No vs Yes			
	P-value	OR Exp (B)	95% CI Lower	95% CI Upper	P-value	OR	95% CI Lower	95% CI Upper
Gender								
Male	.025	.758	.595	.965	.253	.824	.592	1.148
Female	reference							
Age								
18-29	.253	1.431	.775	2.643	.362	1.469	.642	3.358
30-49	.884	.967	.614	1.522	.916	1.034	.553	1.936
50+	referen							

	ce							
Education								
High school	.997	.999	.604	1.653	.163	1.609	.824	3.140
Bachelor Degree	.166	.746	.493	1.129	.441	.804	.462	1.400
Master Degree & Above	reference							
Occupation								
Employee	.256	.753	.462	1.228	.454	1.287	.665	2.489
Business owner	.817	.941	.561	1.578	.943	1.027	.498	2.118
Student	.048	.941	.296	.993	.624	1.232	.536	2.829
Others	reference							
Monthly Income								
<20,000	.020	1.858	1.100	3.139	.171	.594	.282	1.282
20,001-40,000	.189	1.347	.864	2.099	.621	1.155	.653	2.054
>40,000	reference							
Living Arrangement								
Alone	.391	1.206	.786	1.850	.867	.948	.510	1.764
Family without children and/or senior	.545	.923	.712	1.196	.660	1.082	.761	.1537

Family with children and/or senior	reference							
Type of House								
Single House	.671	.923	.737	1.607	.882	1.043	.599	1.817
Town house	.063	1.520	.977	2.364	.197	1.496	.881	2.759
Condominium/Apartment	reference							
Having Congenital Disease								
No	.036	1.406	1.023	1.933	.533	1.144	.749	1.749
Yes	reference							
Had an influenza vaccine before								
Yes	.832	.974	.765	1.24	.716	.940	.673	1.313
No	reference							
Self Rated Physical Health Condition	.786	1.022	.874	1.194	.275	.887	.714	1.101
COVID-19 Related Knowledge	.287	1.048	.961	1.143	.001	.840	.756	.932
Risk Perception of getting COVID-19	.002	.821	.723	.932	.000	.665	.563	.787
Confidence in government handling the	.003	.794	.682	.924	.000	.567	.456	.704

pandemic							
Confidence in public health care system in handing the pandemic	.014	.838	.727	.965	.412	.927	.774	1.111

All of the 799 participants, which was 54.57% of total participants, who were unsure or did not intend to be vaccinated provided a reason for their responses. Participants' reasons for being unsure or not intending to be vaccinated are broadly categorized as preferred different choices of vaccine that were being provided by the government; concerned over side effects (both short and long-term); low risk awareness of getting COVID-19 and other personal reasons such as the inconvenience to travel to vaccinate (Table 4). The most common reasons cited by participants who hesitated or refused vaccination were concerning unforeseen (both short and long-term) side effects (n=504, 63.16%) followed by preferred different choices of vaccine than what was being provided by the government (n=231, 28.95%).

		Not sure N, (%)	No N, (%)	Total N (%)
	Table 4. Reasons for COVID-19 Vaccine Hesitancy			
1	Preferred different choices of vaccine than what was being provided by the government	139 (24.10%)	92 (36.08%)	231 (28.95%)
2	Concerned over unforeseen (both short-term and long-term) side effects	404 (70.02%)	100 (39.22%)	504 (63.16%)
3	Do not feel at risk of getting COVID-19	25 (4.33%)	50 (19.61%)	50 (6.27%)
4	Personal reasons such as not being convenient to travel to get vaccinated	9 (1.56%)	13 (5.10%)	13 (1.63%)
Total				798

Discussion

This representative sample of Thai people, 54.57% of the participants indicated hesitancy or refusal to be vaccinated against COVID-19 with the current vaccine choices being provided. The survey was conducted during an unprecedented rise in the number of COVID-19 cases, starting from 28,889 cumulative cases on 1 April 2021 to 259,301 on 30 June 2021. While the number of deaths increased significantly from 94 to 2,023 during the same period (21). The percentage of individuals who intended to be vaccinated (45.4%) was far lower than the percentage of individuals who had an influenza vaccine before (61.6%), despite the increase in severity of the COVID-19 pandemic, number of deaths, number of cases, and societies being in disruption. This findings could be due to several factors 1) Thailand was able to control the number of COVID-19 infections throughout the year 2020 subsequently most of

participants did not feel at high level of risk contracting COVID-19 even though number of COVID-19 infection cases started to rise during the period of this survey. 2) Most of the participants were not satisfied with the choices of vaccine available, mainly being provided by the government which were only Sinovac or AstraZeneca (8)(10). This finding was different to prior studies in the UK by Elise Paul (11) and the US by Kimberly A. 's (12) who both showed a similar result that having had an influenza vaccine was a predictor for the intention to vaccinate against COVID-19. The study showed that COVID-19 knowledge was at a good level and that participants' risk awareness of COVID-19 was low. This can be because most participants were following COVID-19 news, and many measures were imposed to restrict traveling and outdoors activities. COVID-19 news and updates should be provided to people to increase their knowledge and understanding, so that people are aware of actual risks associated once all COVID-19 measurements were dismissed.

The confidence in the public health care system in handling COVID-19 cases could predict the chance of saying "not sure" vs. "yes" at 83.8%. While the confidence in the government in handling the pandemic could predict the chance of saying "not sure" vs. "yes" and "no" vs. "yes" at 79.4% and 56.7%. Political view was an important factor predicting vaccine acceptance from a study in France[13]. In the UK, the level of confidence in the government was not associated with the prediction of vaccine hesitancy, despite most participants revealing that it was low (11). Contributing factors towards decisions for vaccines in France, the UK and Thailand were different. For instance, the primary vaccines available to the public in Thailand only consisted of Sinovac and AstraZeneca [13]while, Pfizer, Moderna, AstraZeneca, were provided in the UK[14] and in France [12]. Various vaccine types and brands have a range of efficacy and safety that are perceived differently by individuals. For this study, COVID-19 vaccine rejection or hesitation were solely based on the fact that only two vaccines are available, i.e.,Sinovac or AstraZeneca [14]. Other factors contributing to this lack of confidence include the perception of quality and safety of these vaccines [7] [8] [9] [16] being portrayed by the media combined with different COVID-19 vaccine options used in other countries. This was shown in the study by Harapan Harapan[16] in Indonesia where perception of vaccine effectiveness greatly influences willingness to be vaccinated.

Elise Paul et al. [11] carried out a study of vaccine attitudes and COVID-19 intention in the UK in late 2020, which showed a vaccine acceptance rate of 63.5%. Low-income groups with no influenza vaccine last year, poor compliance with COVID-19 government guidelines, being female and living with children were the most important predictors for uncertainty and refusal of COVID-19 vaccines. Kimberly A. Fisher et al. [12] studied attitudes toward a potential SARS-CoV-2 vaccine. A study conducted during 16-20 April 2020 of American adults found that the acceptance rate of COVID-19 vaccines was approximately 40%. The most significant predictor was being young, black with less than a college degree, and no influenza vaccine in the previous year. Acceptance of a COVID-19 Vaccine in Southeast Asia: A Cross-Sectional Study in Indonesia was conducted by Harapan Harapan et al.[16] found that 93.3% of respondents (1,268/1,359) would like to be vaccinated if a vaccine is at least a 95% effective. This acceptance rate decreased to 67% (911/1,359) for a vaccine at 50% efficacy. Hence, vaccine efficacy was one key factor resulting in vaccine acceptance rate. The acceptance and attitudes towards COVID-19 were studied by Tamam El- Elimat et al.[17]. A cross-sectional study in Jordan found that 37.4% of the public accepted COVID-19 vaccines. Among participants taking seasonal influenza vaccine, COVID-19 vaccines were more likely to be accepted. The COVID-19 vaccine uptake was less for participants who believed in a conspiracy around the vaccine programme and those that did not trust information sources regarding COVID-19. A study in France shows that political perceptions also played a large role in the attitude of participants. The acceptance of SARS-CoV-2 vaccines was strongly influenced by their vote in the first round at the presidential election of 2017[13]. Those who voted for a far-right or a far-left candidate were much more likely to refuse vaccination. Other demographic factors were also highlighted in the March 2020 study by COCONEL Group [13] , which found the rate of vaccine hesitation to be at 26%. A study of intention for vaccine among Australian parents (n=2018)

showed that most of them accepted COVID-19 vaccine, with acceptance rate at 82.8%.[18]. A study on the acceptance and associated factors of COVID-19 among 1,144 people in the Middle East by Walid A. Al-Qerem et al. [19], revealed a 63.2% acceptance rate. A Belgium-based study, by Roselinde Kessels et al.[20], showed that 34% (n=651) of participants reported definitely getting vaccinated against COVID-19, and 39% of them (n=742) said they would "probably" be vaccinated.

Vaccine hesitation or refusals were essentially based on the effectiveness and safety, both short-term and long-term of COVID-19 vaccines and level of risks perception of getting COVID-19 of people while the confidence in the government can influence level of COVID-19 vaccine acceptance through a vaccine policy that satisfy people and all the measurements to recover from the COVID-19 pandemic as swiftly as possible.

Limitation

Participants' intention to be vaccinated was explored during a third COVID-19 wave in Thailand, April-June2021, when COVID-19 vaccination started rolling out for the first group, aged 18-60 years old.

Reference

The survey was conducted by Google form, only participants with access to the internet could participate in the study.

Conclusion

COVID-19 related knowledge and risk perception of getting COVID-19 among participants was at a good level and at a moderate level accordingly. 45.4% (n=665) of participants intended to be vaccinated against COVID-19 while 39.4% (n=577) were not sure and 15.2% (n=222) did not intend to be vaccinated. Common reasons for vaccine hesitancy or refusal were concerned over unforeseen side effects of COVID-19 vaccine at 63.16% (504/799) followed by preference for more choices of COVID-19 vaccine than what was provided by the government at 28.95% (231/799). COVID-19 related knowledge and all the updates should be provided thoroughly and widely for people to understand and keep updated so that people truly understand and can make the right decision for themselves. While providing more options of COVID-19 vaccine for people should be implemented because different types of vaccines are suitable for different groups of people, moreover people should have rights to choose what they believe is best for themselves.

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