Intention to vaccinate against COVID-19 of high school students aged 16-18 years old in Thailand: Cross sectional online survey

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บทคัดย่อ

ความสำคัญของปัญหา: COVID-19 เกิดการระบาดใหญ่ทั่วโลก การพัฒนาวัคซีนดำเนินไปควบคู่กับการควบคุมการระบาดอย่างรวดเร็วเมื่อวัคซีนพร้อมในการนำมาฉีดให้ประชาชน จำเป็นที่ประชาชนรับวัคซีนให้ความครอบคลุมสูงสุดเพื่อสร้างภูมิคุ้มกันหมู่ และควบคุมการระบาดของ COVID-19 นโยบายการจัดหาวัคซีนที่มีข้อจำกัดด้านตัวเลือกส่งผลต่อความเต็มใจรับวัคซีนของประชาชน โดยเฉพาะกลุ่มอายุต่ำกว่า 18 ปี ที่ยังไม่มีการจัดหาวัคซีนที่เหมาะสม ในขณะที่การค้นพบใหม่ๆเกิดขึ้นจากโรคอุบัติใหม่นี้ตลอดเวลา ความรู้และความเข้าใจ ส่งผลต่อความตระหนักและการรับรู้ความเสี่ยงต่ออันตรายจากโรค

วัตถุประสงค์: เพื่อประเมินความรู้ความเข้าใจเกี่ยวกับ COVID-19 การรับรู้ความเสี่ยงติด COVID-19 ความตั้งใจรับวัคซีนป้องกัน COVID-19 และ เพื่อศึกษาปัจจัยทำนายและสาเหตุของความลังเลในการรับวัคซีน COVID-19 กลุ่มตัวอย่างคือนักเรียนมัธยมปลายอายุ 16-18 ปีที่อาศัยอยู่ในประเทศไทย วิธีการศึกษา: แบบสำรวจออนไลน์แบบภาคตัดขวาง จัดทำตั้งแต่เดือนเมษายน 2564 ถึง มิถุนายน 2564 ประชากรและกลุ่มตัวอย่าง: นักเรียนมัธยมศึกษาตอนปลายอายุ 16-18 ปี คนทั่วประเทศไทยที่สามารถเข้าถึงอินเทอร์เน็ตผ่านสมาร์ทโฟนหรือคอมพิวเตอร์ส่วนบุคคลได้

ผลวิจัย: มีผู้เข้าร่วมการวิจัยจำนวน 2,173 ราย อายุระหว่าง 16-18 ปี ส่วนใหญ่เป็นเพศหญิง (n=1,577, 72.57%) คะแนนเฉลี่ยระดับความรู้เกี่ยวกับ COVID-19 อยู่ระดับกลาง (M=7.83, SD=1.38) จากคะแนนเต็ม 10 การรับรู้ความเสี่ยงติด COVID-19 อยู่ระดับต่ำ (M=2.83 , SD=1.09) และ ความตั้งใจรับวัคซีน COVID-19 โดย 23.6% (n = 513) ของผู้เข้าร่วมจะรับการฉีดวัคซีน 40.9% (n = 889) ไม่แน่ใจ 35.48% (n = 771) ไม่ต้องการรับการฉีดวัคซีน ปัจจัยที่เกี่ยวข้องต่อความลังเลการรับวัคซีน ("ไม่แน่ใจ" หรือ "ไม่รับ") ได้แก่ เพศหญิง อาศัยอยู่กับครอบครัวที่มีเด็กอายุต่ำกว่า 12 ปี และ/หรือผู้อาวุโส มีความรู้เกี่ยวกับ COVID-19 การรับรู้ความเสี่ยงในการติด COVID-19 ความเชื่อมั่นในรัฐบาลในการจัดการโรคระบาด ความเชื่อมั่นในระบบสาธารณสุขในการจัดการกับโรคระบาด และสภาพสุขภาพร่างกายประเมินตนเอง เหตุผลหลักของความลังเลหรือปฏิเสธวัคซีน คือ ต้องการตัวเลือกวัคซีนมากกว่าที่รัฐบาลจัดให้ 75.12% และความกังวลเกี่ยวกับผลข้างเคียงจากการฉีด COVID-19 วัคซีน (ทั้งในระยะสั้นและระยะยาว)

สรุปผลวิจัย:

ผู้ตอบแบบสอบถามมีความรู้เกี่ยวกับ COVID-19 อยู่ระดับกลาง และการรับรู้ความเสี่ยงติด COVID-19 อยู่ในระดับต่ำ 76.38% ของผู้ตอบแบบสอบถาม ลังเล และไม่ต้องการการรับวัคซีนที่รัฐบาลจัดหาให้ เนื่องจากมีความกังวลผลข้างเคียงจากการฉีดวัคซีน ต้องการตัวเลือกวัคซีน COVID-19 มากกว่าที่ได้รับการจัดหา ณ ขณะที่ทำการศึกษา จากผลการวิจัยแนะนำให้ควรมีการจัดหาวัคซีนที่หลากหลายเหมาะสมกับกลุ่มที่แตกต่าง เพื่อเพิ่มความเต็มใจของประชาชนในการรับวัคซีน และควรส่งเสริมให้ความรู้เกี่ยวกับสถานการณ์ COVID-19 ที่อัพเดท อย่างทั่วถึงเพื่อให้เกิดการตระหนักถึงความเสี่ยงเพิ่มมากขึ้น

คำสำคัญ: วัคซีนโควิด-19, การรับวัคซีนโควิด-19

Abstract

Background: Coronavirus disease 2019 (COVID-19), an emerging disease, has rapidly instigated a global pandemic. Vaccine development is proceeding at an unprecedented pace along with controlling the pandemic. Once available, it will be important to maximize vaccine uptake and coverage. While vaccine policy which choices of vaccine were limited affected intention to be vaccinated especially aged group below 18 years, there was no procurement plan for this group yet. New discoveries on COVID-19, an emerging disease, had been found all the time, knowledge and understanding, in this regard, acted on awareness and risk perception of the disease.

Objective: To assess COVID-19 related knowledge, risk perception of getting COVID-19 and intention to be vaccinated against COVID-19 among a representative sample of high school students aged 16-18 years living in Thailand. Moreover, predictors of and reasons for vaccine hesitancy to be identified.

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

Participants: Approximately 2,173 high school students aged 16-18 years across Thailand with access to the internet via smartphone or personal computers.

Results: A total of 2,173 responses were received. Participants aged between 16-18 years. Most participants were female (n=1,577, 72%). Participants revealed a moderate level of COVID-19 related knowledge (M=7.83, SD=1.38), a moderate level of risk perception of getting COVID-19 (M=2.83, SD=1.09). Overall, 23.6% (n = 513) of participants intended to get vaccinated, 40.9% (n = 889) were unsure, and 35.48% (n = 771) did not intend to get vaccinated. Factors that are independently related to vaccine hesitancy ("not sure" or "no" response) include being female, living with family with children aged below 12 years old and /or with a senior member, knowledge about COVID-19, risk perception of getting COVID-19, confidence in the government in handling the pandemic, confidence in public health care system in handling the pandemic and self-rated physical health condition.

Conclusion: COVID-19 related knowledge was at a moderate level and risk perception of getting COVID-19 among participants was at a low level. 76.38% of participants were unsure or did not intend to be vaccinated of what being provided due to concerning over side effects, prefer more choices of vaccine over what being provided. From the results, it is recommended that more choices of vaccines be procured to suitable for different groups and to increase willingness to be vaccinated along with promoting knowledge about the COVID-19, updating COVID-19 situation thoroughly in order to increase risk awareness.

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

Introduction

COVID-19 is the disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the coronavirus that emerged in December 2019. More than 190 million people worldwide have been infected as of 18 Jul 2021.[1] COVID-19 spreads from person to person and become widespread. Symptoms can range from asymptomatic to mild. For example, fever, cough, fatigue, sore throat, stuffy nose, runny nose, diarrhea, loss of taste, and loss of smell. People with chronic diseases such as high blood pressure, heart disease, diabetes or cancer are more likely to have serious illnesses than young people and people without underlying medical conditions. However, anyone can still be infected with COVID-19 and may be severely ill. COVID-19 has a negative effect on people around the world in many dimensions,

in terms of illness, health, economic, social or psychological factors.

The development of a vaccine to build immunity for people and reduce the infection rate of COVID-19 is one of the most important ways of stopping COVID-19 spread. Additional measures are wearing masks, washing hands and social dissociation that has been incorporated around the world during the period following its outbreak. With this urgent task, scientists around the world focused on developing a COVID-19 vaccine. Many countries made the vaccine available to the public, such as Israel (66.33% of the population) and UK (68% of the population), USA (54.55% of the population) and Indonesia (14.96% of the population) have vaccinated their citizens (as of 15 July 2021). Currently, more than 13.82 million doses, are used to vaccinate 10.42 million people which makes up 14.93 percent of Thailand's population.[2] 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.

Various COVID-19 vaccines were urgently developed to control the pandemic. The UK, which was soon followed by several other nations, became the world's first country to start administering its citizens with a fully-tested COVID-19 vaccine on 8 December 2020.[3] Various technologies have been used in COVID-19 development: 1) A Pfizer-BioNTech protective vaccine was found to be more effective than a placebo in the prevention of symptomatic disease in the UK (B.1.1.7). The vaccine was equally effective in a wide range of people with diverse variables, including age, sex, breed, ethnicity and body weight (BMI). 2) Moderna effectiveness in preventing symptomatic infections in people without evidence of COVID-19 infection was up to 94.1 percent. It is also effective against B.1.1.7 or the alpha variant. It appears to be very effective in clinical trials with vaccinated patients of various years, gender, races and ethnicity and people with underlying health conditions. 3) A single shot of Johnson and Johnson's overall efficiency in USA was 72%, while the protection against B.1.1.7 was 86%. 4) AstraZeneca could reduce the risk of symptomatic by up to 76 % 15 days or more after receiving both doses and 100% effective in preventing the development of serious symptoms. 85% effective in preventing COVID-19 among people over 65 and 74.6 % effective against the B.1.1.7 variant. 5) For mild and moderate diseases, the efficacy of Novavax against the original strain of COVID-19 developing serious

conditions increased to around 96.4% to 100%. The efficiency in the UK is 86.3% with the B.1.1.7 variant and 55.4% against the B.1.351 or the beta variant for HIV participants (in Phase 2B). In contrast to Pfizer-BioNTech and Moderna vaccines, potential side effects in Novavax are significantly lower. Common symptoms reported after vaccination were similar to those already associated with COVID-19 vaccine, such as fatigue, headache and muscle pain.[4] 6) Sinovac is produced by Sinovac Biotech (Coronavac) (China-based pharmaceutical company). An inactivated vaccine using beta-propiolactone of the SARS-CoV-2 virus. The chemical changes the genetic material of the virus. The portion of the disease virus is destroyed, but its basic genetic information is still available (trains the immune system). Double-dose vaccine is required for people 18 years and older. The Brazilian trial indicates the efficacy rate of 50.4 % while the study of the vaccine rollout in Chile shows the efficacy of 67%. [5] Sinovac plans to continue with its clinical trials to determine the effectiveness and timing of the booster shot and the efficacy of the vaccine against emerging variants of SARS-CoV-2. The development of vaccine against new variants are in process.[5] 7) Sinopharm is recommended by the WHO as a vaccine for people aged 18 years and older, with a gap of 3–4 weeks between two doses. The global health agency estimates overall vaccine efficacy to be about 78% but it lacks data on people who are older than 60. Among the 5.9 million people who had received the vaccine in China by 30 December 2020, 1,453 reported adverse side effects which is a relatively low percentage. [5] 8) Sputnik Viral Vector vaccine contains the gene for the spike protein and deliver this into cells after injection. The cells then make the spike protein and present it to our immune system. Sputnik V is a two-part adenovirus viral vector vaccine with an efficacy rate of 91.6%.[6] Currently there were many choices of COVID-19 vaccine being developed in different phases, many of them being rolled out for millions of people around the world.

As an emerging disease, COVID-19, new discoveries of this disease have been found all the time, knowledge and understanding about the disease makes people aware of actual risk associated. However, many of the efficacy, safety, and long-term side effects, attitudes and beliefs towards vaccines and other related issues still remain. The COVID-19 vaccine policy and plan implemented were different for each country, which affected availability of COVID-19 vaccine for different groups and, in turn, raise doubts or uncertainties

that could lead to refusal or hesitation of getting vaccines. Ultimately, this is a significant public health problem in the control of the pandemic.

At the time of conducting this study, Thailand vaccine policy was to provide Sinovac and AstraZeneca[7], therefore, the aim of this research was to study the intention to vaccinate against COVID-19 and factors that affect high school students' decision, aged 16-18, to vaccinate. This group will constitute Thailand's next vaccination group against COVID-19. 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 high school students' COVID-19 related knowledge, risk perception of getting COVID-19 and intention to be vaccinated against COVID-19. The survey was released to students 16-18 years of age at a high school level in Thailand. An invitation was sent to their high school and college prep social media groups during 1 April-30 June 2021 with a total of 2,173 students responded. All participants completed surveys via Google form.

Instrument

The questionnaire was developed based on a literature review including:

(1) Information provided by 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) 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.

A preliminary version of the instrument was reviewed by three infection control specialists to validate its content and the Cronbach's alpha (α = 0.80) also showed that it was acceptable. A small sample of high school students were asked to complete the test to check 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 consisted 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 comprised of 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 consisted 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 from high school students aged 16-18 years old. We used an online Google Form to collect data from students who belong to social media groups. The invitation was sent to social media groups used by students. 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

A total of 2,173 responses were received, a majority of participants were female (n=1,577, 72.57%), aged between 16-18 years, living with family without any children or senior member (n=1,053, 48.46%). 84.3 % (n=1,826) of participants reported having no congenital disease and 84.03 % (n=1,826) reported living in a single house (n=1,486, 68.4%) and 68.02% (n=1,478) of participants had receipt of influenza vaccination.

Students revealed a moderate level of COVID-19 related knowledge with an average score of 7.83 (SD=1.38) from a total of 10. Most participants revealed a low level of risk perception of getting COVID-19 (M=2.83, SD=1.09); a low level of confidence in the government in handling the pandemic (M=1.64, SD=0.94); and a low level of confidence in the public health care system in handling COVID-19 cases (M=2.37, SD=1.09), all from a total of 5.

The level of physical health perception among participants was at a moderate level. Female students showed slightly higher knowledge scores and higher risk perception of getting COVID-19 than male students. While, male showed a slightly higher level of confidence in the government and in the public health care system in handling COVID-19 cases and higher level of physical health perception.

Participants who reported living with family without children and /or without senior member showed the highest level of knowledge about COVID-19 and the highest level of risk perception of getting COVID-19 and the highest 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 1.64 (SD=0.94) showed a low level of confidence in the public health care system at an average score of 2.37 (SD=1.09). Participants who reported living in a single house had the highest level of COVID-19 related knowledge (M=7.85, SD=1.41), the highest level of risk perception of getting COVID-19 (M=2.83, SD=1.07) and the highest level of confidence in the government in handling COVID-19 (M=1.70, SD=0.98) among other groups.

Participant with congenital disease showed higher level of knowledge about COVID-19 (M=7.84, SD=1.37) and risk perception of getting COVID-19 (M=2.93, SD=1.08) than the group without congenital disease. While, participants who reported not having congenital disease had higher level of confidence in the government handling COVID-19 (M=1.56, SD=0.92) and higher level of confidence in the public health care system in handling COVID-19 cases (M=2.40, SD=1.05).

Table 1. Sociodemographic Characteristics (N=2,713)

Characteristics	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)
Gender							
Male	596	27.43	7.81 (1.45)	2.77 (1.09)	1.69 (1.0)	2.43 (1.08)	3.79 (0.809)
Female	1,577	72.57	7.83 (1.35)	2.85 (1.09)	1.63 (0.92)	2.34 (1.10)	3.72 (0.837)
Living Arrangement							
Family without children and/or senior member	971	44.68	7.93 (1.35)	2.85 (1.08)	1.7 (0.98)	2.39 (1.11)	3.70 (0.835
Family with children and/or senior member	1,053	48.46	7.75 (1.41)	2.83 (1.09)	1.64 (0.93)	2.34 (1.07)	3.76 (0.807)
Living alone	149	6.86	7.72 (1.32)	2.68 (1.11)	1.32 (0.69)	2.41 (1.07)	3.79 (0.948))
Type of House							
Single House	1,486	68.4	7.85 (1.41)	2.83 (1.07)	1.70 (0.981)	2.35 (1.12)	3.72 (0.835)
Town House	388	17.9	7.68 (1.30)	2.82 (1.04)	1.56 (0.862)	2.39 (1.07)	3.71 (0.792)
Apartment or Condo	299	13.8	7.68 (1.35)	2.83 (1.22)	1.47 (0.816)	2.42 (0.953)	3.88 (0.841)
Having Congenital Disease							
No	1,826	84.03	7.82 (1.38)	2.81 (1.09)	1.65 (0.95)	2.37 (1.09)	3.75 (0.831)
Yes	347	15.97	7.84 (1.37)	2.93 (1.08)	1.59 (0.88)	2.36 (1.07)	3.65 (0.824)
Had a flu vaccine before							
Yes	1,478	68.02	7.91 (1.4)	2.87 (1.09)	1.68 (0.95)	2.35 (1.11)	3.68 (0.824)
No	695	31.98	7.66 (1.32)	2.73 (1.07)	1.56 (0.92)	2.40 (1.05)	3.85 (0.831)
Total	2,173	100	7.83 (1.38)	2.83 (1.09)	1.64 (0.94)	2.37 (1.09)	3.74 (0.830)

Overall, 23.6 % (n=513) of the participants intended to be vaccinated against COVID-19, 40.9% (n=889) were not sure whether they would be vaccinated, and 35.48% (n=771) didn't intend to be vaccinated. The combined data among those who hesitated and refused vaccines was 76.39 % of all participants (n=1,660). Factors associated with intention to vaccinate were gender, living arrangement, having an influenza vaccine before and physical health perception of themselves.

COVID-19 vaccine acceptance rate of male participants was 33.05% (n=197) while female participants was 20.03% (n=316). Participants who reported living with family without children aged below 12 years and/or without senior member had the highest COVID-19 vaccine acceptance rate at 26.78%, (n=260). Participants who had an influenza vaccine before had a higher acceptance rate than those who have not had it at 25.64% (n=379). Participants who perceived their physical health as very good had the highest COVID-19 acceptance rate at 27% (n=95). Table 2

Table 2. Intent to Be Vaccinated, by Participant Characteristic

Characteristic	N	Intention to be vaccinated, n %			P Value
		Yes (n=513, 23.6%)	Not sure (n=889, 40.9%)	No (n=771, 35.48%)	
Gender					.000
Male	596	197 (33.05)	205 (34.40)	194 (32.55)	
Female	1,577	316 (20.03)	684 (43.37)	577 (36.59)	
Living Arrangement					.000
Family without children and/or senior member	971	260 (26.78%)	390 (40.16%)	321 (33.06%)	
Family with children and/or senior member	1,053	215 (20.42%)	457 (43.40%)	381 (36.18%)	
Living alone	149	38 (25.5%)	42 (28.19%)	69 (49.31%)	
Type of house					.167
Single house	1,486	341 (21.13%)	622 (41.86%)	523 (35.19%)	
Town house	388	94 (4.23%)	164 (42.27%)	130 (33.51%)	
Condominium / Apartment	299	78 (26.09%)	103 (34.45%)	118 (39.46%)	
Had Congenital Disease					.665
No	1,826	426 (23.33%)	754 (41.29%)	646 (35.79%)	
Yes	347	87 (25.07%)	135 (38.90%)	125 (36.02%)	
Having an influenza vaccine before					.000
Yes	1,478	379 (25.64%)	616 (41.68%)	483 (32.70%)	
No	695	134 (19.28%)	273 (39.28%)	288 (41.44%)	
Physical Health Perception					.004
Very good	342	95 (27%)	114 (33.33%)	133 (38.89%)	
Good	1094	271 (24.77%)	442 (40.40%)	381 (34.83%)	
Moderate	581	112 (19.28%)	264 (45.44%)	205 (35.28%)	
Weak	136	34 (25%)	60 (44.12%)	42 (30.88%)	
Very weak	20	1 (4.7%)	9 (45%)	10 (50%)	

Factors that were independently associated with vaccine acceptance (response of "yes" or "not sure") included being male (OR= 2.094, [95% IC, 1.642-2.67]). Consequently, male participants were 2.09 times more likely to say "yes" than female participants. Living with family with children and /or with senior member contributed to 48.6% lesser chance to say "yes" than participants who reported to be living alone (OR= 0.514, [95% IC, 0.313-0.848].

Participants who reported having had an influenza vaccine before (OR= 1.304, [95% IC, 1.011-1.683]) had a 1.304 times higher chance to say "yes" than participants who had not. Risk perception of getting COVID-19 (Exp β =1.35, p<0.01), self-rated health condition (Exp β =1.29, p<0.01), confidence in the public health care system in handling COVID-19 cases (Exp β =1.17, p<0.01) and COVID-19 related (Exp β =1.11, p<0.01) were predictive factors for chances of saying "yes" than "not sure" at 135%, 129%, 117% and 111%, respectively, which were statistically significant.

Vaccine acceptance (response of "yes" or "no") associated factors were being male (OR= 1.866, [95% IC, 1.444-2.411]). As a result, male participants had a 1.44 times higher chance of saying "yes" than "no." Participants who had an influenza vaccination before (OR= 1.579, [95% IC, 1.228-2.077]) had 159% higher possibilities of saying "yes" than "no" than those who had not. The level of confidence in the government handling the pandemic (OR=1.853, [95% IC, 1.593-2.156], p<0.01), risk perception of getting COVID-19 (Exp β=1.53, [95% IC, 1.367-1.712], p<0.01), confidence in the public health care system in handling COVID-19 cases (Exp β=1.322, [95% IC, 1.322-1.322], p<0.01), self-rated physical health condition (Exp β=1.187, [95% IC, 1.022-1.378], p<0.05) and COVID-19 related knowledge (Exp β=1.127, [95% IC, 1.03-1.232], p<0.01) were predictive factors that affect the decision of saying "yes" than "no" at 1.53%, 132%,118% and 112% 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.

Characteristic	Intention to be vaccinated: Yes vs Not sure				Intention to be vaccinated: Yes vs No			
	P-value	OR	95% CI Lower	95% CI Upper	P-value	OR	95% CI Lower	95% CI Upper
Gender								
Male	.000	2.094	1.642	2.67	.000	1.866	1.444	2.411
Female		Reference						
Living Arrangement								
Family without children and/or senior member	.195	0.72	0.438	1.183	.540	1.16	0.721	1.865
Family with children and/or senior member	.009	0.514	0.313	0.844	.495	0.848	0.529	1.36
Living alone		Reference						
Type of House								
Single House	.118	0.76	0.54	1.072	.337	0.843	0.596	1.194
Town house	.172	0.755	0.504	1.13	.955	1.012	0.668	1.532
Condominium/Apartment		Reference						
Having Congenital Disease								
No	.378	0.872	0.643	1.183	.676	0.934	0.679	1.285
Yes		Reference						
Had an influenza vaccine before								
Yes	0.041	1.304	1.011	1.683	.000	1.597	1.228	2.077
No		Reference						
Self-rated Physical Health Condition	.000	1.293	1.123	1.49	.024	1.187	1.022	1.378
COVID-19 Related Knowledge	.010	1.117	1.027	1.215	.009	1.127	1.03	1.232
Risk Perception of getting COVID-19	.000	1.347	1.21	1.499	.000	1.53	1.367	1.712
Confidence in government handling the pandemic	.665	0.975	0.868	1.095	.000	1.853	1.593	2.156
Confidence in public health care system in handing the pandemic	.004	1.171	1.052	1.304	.000	1.322	1.322	1.322

All of the 1,660 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 than 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 not being convenient to travel for vaccination (Table 4). The most common reasons cited by participants who hesitated or refused vaccination were preference for different choices of vaccine than what was provided by the government.

Table 4. Reasons for COVID-19 Vaccine Hesitancy

	Particulars	Not sure N, (%)	No N, (%)	Total N (%)
1	Preferred different choices of vaccine than what was being provided by the government	590 (66.37%)	657 (85.21%)	1,247 (75.12%)
2	Concerned over unforeseen (both short-term and long-term) side effects	267 (30.03%)	98 (12.7%)	365 (21.98%)
3	Do not feel at risk of getting COVID-19	26 (2.9%)	12 (1.56%)	38 (2.3%)
4	Personal reasons such as not being convenient to travel to get vaccinated	6 (.067%)	4 (0.52%)	10 (0.6%)

The analysis of Pearson's correlation coefficient between the study outcomes found that there was a positive correlation between COVID-19 related knowledge and risk perception of getting COVID-19 (r=.147**, p=0.01); between risk perception of getting COVID-19 and confidence in the government in handling the pandemic (r=.050*, p=0.05); and between risk perception of getting COVID-19 and confidence in public health care system in handling the pandemic (r=.063**, p=0.01). The analysis showed a strong positive correlation between confidence in the government handling the pandemic and confidence in health care system in handing the pandemic (r=.324**, p=0.01). All of the data above were statistically significant. (Table 5)

Table 5. Pearson's correlation coefficient between the study outcomes

Particulars	Perception of Physical Health	Knowledge about COVID-19	Risk of Getting COVID-19	Confidence in the government in handling the pandemic	Confidence in health care system handling the cases
Perception of Physical Health	1	-.048*	-0.018	-.060**	.052*
Knowledge about COVID-19	-.048*	1	.147**	0.002	-.045*
Risk of Getting COVID-19	-0.018	.147**	1	.050*	.063**
Confidence in the government in handling the pandemic	-.060**	0.002	.050*	1	.324**
Confidence in health care system in handling the pandemic	.052*	-.045*	.063**	.324**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Discussion

This representative sample of grade 10-12 students, 76.39% of the participants indicated hesitancy or refuse to be vaccinated against COVID-19 with current vaccine choices being provided. Although the survey was conducted during an unprecedented rise in the number of COVID-19 cases, going from 28,889 cumulative cases on 1 April 2021 to 259,301 on 30 June 2021, and number of deaths increased significantly from 94 to 2,023 during the same period,[1] this finding was especially striking as more than half of the participants hesitated or turned down getting vaccinated regardless of whether or not they were included in the first vaccine roll out. The percentage of individuals who intended to be vaccinated (23.61%) was far lower than the percentage of individuals who had an influenza vaccine before (68.20%), despite the increase in severity of the COVID-19 pandemic, number of deaths, number of cases, and societies being in disruption. This finding was different from prior studies in the UK by Elise Paul[8] and the US by Kimberly A.'s[9] which showed a similar result that having had an influenza vaccine was a predictor for intention to vaccinate against COVID-19. The study showed

that COVID-19 knowledge was at an average level and that students' risk awareness of COVID-19 was low. This can be because more students had other focuses than following COVID-19 news, and many measures were imposed restricting their travel and activities outdoor. These two factors were positively correlated (r=.147**, p<0.01) and had a statistically significant effect with the intention to vaccinate against COVID-19. Educational health campaign for COVID-19 should be provided to students to increase their level of knowledge and understanding, so that students are aware of actual risks associated once all COVID-19 measurements were dismissed. Self-rated physical health conditions could predict possibilities of saying "yes" vs. "not sure" at 129% and likelihood of saying "yes" vs. "no" at 118%. The participants' physical health perception was assessed to be moderate on average. Participants were mainly physically healthy as young people. The level of confidence in the public health care system in handling COVID-19 cases could predict the chance of saying "yes" vs. "not sure" at 117% and chance of saying "yes" vs. "no" at 132%. The confidence in the public health care system in handling COVID-19 cases and the confidence in the government were positively correlated (r=.324**, p<0.01). The confidence in the public health care system in handling COVID-19 cases could predict the chance of saying "yes" vs. "not sure" and "yes" vs "no" at 171% and 132%, respectively, which were statistically significant. Political view was an important factor predicting vaccine acceptance from a study in France.[10] 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.[8] Contributing factors towards decision for vaccines among France, the UK and Thailand were different. For instance, the primary vaccine available for the public in Thailand only consisted of Sinovac and AstraZeneca[7] while, Pfizer, Moderna, AstraZeneca, were provided in the UK[11] and in France.[10] 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 available, i.e., Sinovac or AstraZeneca.[7] Other factors contributing to this lack of confidence include the perception of quality and safety of these vaccines [12,13,14,15] 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[15] in Indonesia where

perception of vaccine effectiveness greatly influences willingness to be vaccinated.

Elise Paul et al.[8] 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. Concern about side effects and natural immunity were the two most negative attitudes towards COVID-19 vaccines. Kimberly A. Fisher et al.[9] 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. The principal reasons for vaccine hesitation include the lack of information on vaccinations; anti-vaccine attitudes; beliefs; emotions; and the lack of trust in the government, CDCs, pharmaceutical companies and the development processes of vaccines. The acceptance and attitudes towards COVID-19 were studied by Tamam El- Elimat et al.[16] 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. Acceptance of a COVID-19 Vaccine in Southeast Asia: A Cross-Sectional Study in Indonesia was conducted by Harapan Harapan et al.[15] 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 acceptancy 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. 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.[10] 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,[10] which found the rate of vaccine hesitation to be

at 26%. Those who refused vaccination were among low-income and young women population with people over 75 and retired at the highest. A 15-23 June 2020 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%. Those who refused deemed vaccine efficiency and safety concerns to be their top priorities and considered a COVID-19 vaccine to be unnecessary. Hesitancy or refusal in vaccines was associated with the population group of over 60, a lower educational background and a poor knowledge of the recommended actions needed to prevent being infected by COVID-19. However, personal cultural background, i.e., country of birth or native language was unrelated to the admission of vaccinations.[17] 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,[18] revealed a 63.2% acceptancy rate. Concern and lack of trust in vaccine use were the main reasons the participants refused or were hesitant. 30.4% of participants believed they were at a high-risk of contracting COVID-19 while 27.5% considered themselves to be at medium-risk. Overall, the knowledge of COVID-19 participants had been high. Many participants followed practices of protection very closely. A Belgium-based stud, by Roselinde Kessels et al,[19] showed that 34% (n=651) of participants reported to definitely getting vaccinated against COVID-19, and 39% of them (n=742) said they would "probably" be vaccinated. Age, government opinion in the context of the COVID-19 pandemic, medical risk and spoken language played the most significant role in the decision-making process. Among the group under 54 years of age, COVID-19 vaccine hesitation has been more pronounced.

Vaccine hesitation or refusals were primarily based on the effectiveness and safety, both short-term and long-term of COVID-19 vaccines, as well as the attitudes and beliefs about vaccines and public trust.

Limitation

When the research took place during the third COVID-19 wave in Thailand, from April to June 2021, COVID-19 vaccination rollout began for 18-60 age group which excluded the majority of the participant in this study (aged 16-18). Moreover, the Google form survey was limited to students with access to the internet and a connecting device who belong to school social media groups.

Conclusion

COVID-19 related knowledge and risk perception of getting COVID-19 among high school participants was at a moderate and at low level accordingly. 23.6% (n=513) of participants intended to be vaccinated against COVID-19 while 40.9% (n=889) were not sure and 35% (n=771) did not intend to be vaccinated. Common reasons of vaccine hesitancy or refusal were preference for more choices of COVID-19 vaccine than what was provided by the government at 75.12% (1247/1660) and concerning (both short-term and long-term) side effects at 21.98% (365/1660). Providing more options of COVID-19 vaccine for people should be implemented because different types of vaccines are suitable for different groups of people. In a pandemic where vaccine is in high demand worldwide, vaccine management policy and plan should carry out carefully to cover all risks as well as preventive and protective plans in place. Knowledge of COVID-19 and participants' risk perceptions were relatively moderate in predicting the acceptance of vaccines. Systematic interventions are needed for deeper understanding of COVID-19 among students by providing COVID-19 related information instantly and consistently on different platforms not only to enhance their knowledge but also to increase their risk awareness and reducing the hesitancy of getting vaccines. Lastly, the deciding factor for participants in this age group in vaccine uptake is the choice of vaccine available. Providing that the government can offer more efficient vaccines, the remaining factors would not be an issue affecting their decision to get vaccinated.

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