

Immunization and vaccine related knowledge among high school students in Bangkok, Thailand

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Abstract

Objective: This study aims to assess the level of immunization and vaccine knowledge among high school students. **Methods:** The study was conducted using a questionnaire. A total of 214 highschool students participated. Immunization and vaccine related knowledge were assessed. Descriptive statistics were used to analyze the outcome of this study. **Results:** A total of 214 high school students participated in this study, the majority of participants were female (n=150, 70.1%). Most participants studied in grade 12 (n=129, 56.1%). Participants enrolled most in the Math-Science program (n=188, 87.9%). Parents of most participants worked as an employee (n=59, 27.6%) and the majority of monthly household income was 40,001-80,000 Baht (n=57, 26.6%). Participants learned about immunization and vaccine knowledge from social media (n=110, 51.9%). From the assessment of basic immunization and vaccine knowledge among participants, the average knowledge about immunization and vaccine knowledge score was at a moderate level (M=11.34, SD=2.43). Female participants showed a higher knowledge score (M=11.52, SD=2.20) than male participants' (M=10.91, SD=2.85). Grade 12 participants showed the highest average knowledge score (M=11.64, SD=2.09) among other classes. Participants who enrolled in the Math-Science program had the highest average knowledge score (M=11.48, SD=2.43). Participants whose parents worked in Health Science revealed the highest average knowledge score (M=12.67, SD=2.63) and the monthly household income group of <150,000 showed the highest average knowledge score (M=12.17, SD=2.04). Participants who learned about immune system and vaccine knowledge from doctors they visited for treatment revealed the highest knowledge score (M=13.00, SD=1.54). **Conclusion:** Immunization and vaccine related knowledge among participants was at a moderate level.

Keyword: immunization knowledge, vaccine knowledge, high school students

1. INTRODUCTION

Pandemic of Covid-19 is an ongoing global outbreak of the coronavirus disease 2019 (COVID-19; COVID-19) is caused by a new strain of coronavirus. It was firstly discovered in Wuhan, Hubei, China in December 2019. The World Health Organization declared the outbreak an international public health emergency on January 30, 2020 and declared a pandemic on March 11, 2020. Accordingly on May 26, 2020, 2021 Greenwich Mean Time 7:04 a.m., more than 168,535,137 confirmed cases in 220 countries and territories have died from the epidemic, more than 3,500,046 people and more than 150,076,676 people have recovered [1]. Disease control used by all countries since reducing travel by the area restriction, airport closure, social distancing measures, close the trading place and economic activities, restrict the city and etc., which have an impact on the disruption of the economy, production work, tourism, downstream industries, hotels, restaurants, as well as production in the industrial, trading and investment sectors severely. Even the world economy is entering an economic crisis. [2] As a result, governments in many countries are accelerating the search for a vaccine against COVID-19 from all over the world to control the spread of COVID-19. The COVID-19 outbreak continues and there was no sign of cessation. However; efforts to restrain the severity of the epidemic never ceased. The COVID-19 vaccine is an

important tool to save the lives of many people globally. The Covid-19 vaccine has been developed for a limited time to be able to respond to the situation "Global pandemic" of emerging diseases in time. Despite the greatly shortened development time compared to other vaccines, the development of a COVID-19 vaccine has not compromised the quality and safety of vaccines. From over 200 laboratory-level vaccine options around the world. It goes through rigorous development, control and evaluation processes of performance, quality and safety until it is certified by the Vaccine Quality Supervision Agency to be able to use only a few products throughout the period since the start of the first vaccination viral mutations occur rapidly. There is an outbreak of worrying species with many waves but from collecting data around the world, it was found that Vaccination with booster needles containing vaccines is still effective in reducing the rate of severe morbidity and significantly reduced mortality in people who received the vaccine. From the report on results of follow-up treatment 2 months after recovering from COVID-19 found that many patients had persistent symptoms across multiple body systems and found that some patients had symptoms showing the new abnormalities. Many later studies have reported unusual symptoms after recovering from COVID-19 in a similar manner to symptoms after recovering from COVID-19. There is a possibility that from the re-infection of the new coronavirus 2019 mutation or caused by a virus that has previously caused a disease that is in the resting state, is activated (Reactivate) to show symptoms again or may be caused by a new pathogenic mechanism persistent symptoms or syndromes or new abnormal symptoms lasting longer than 4 weeks in people who have recovered from COVID-19 and not caused by infection with the new coronavirus 2019 mutated again and was not caused by a virus that was urged to relapse. There are different callings such as Long COVID, Post-COVID 19 Condition, Post-acute COVID syndrome, consequences after contracting COVID- 19 Acute (Post-acute Sequelae of COVID-19; PASC), Long-Haul COVID and Chronic COVID-19, etc. [3]. Mechanism to prevent viral infection in the human body is the immune system.

Human body has a defense mechanism against pathogens, namely the immune system. The immune system is one of the most important systems of living organisms, responsible for sensing impure objects that come into contact with or enter the body in daily life. All impure objects have the potential to come into contact with or enter the human body through various forms such as direct or indirect exposure through the gastrointestinal tract, skin and air [4]. The immune system will try to destroy or react in order to quickly eliminate the impure from the body. The functioning of the immune system consists of 2 subsystems: innate immunity and adaptive immunity. Innate immunity is the body's first barrier that recognizes and destroys impure objects. The major PRRs, including Toll-like receptors (TLRs), NOD-like receptors (NLRs), and RIG-L-like receptors (RLRs), recognize the natural molecular structure of the impure objects in the body. Patho-gen-associated molecular patterns (PAMPs), such as lipoproteins, lipopolysaccharides and the pathogen's genetic material is also perceived to the damage-associated molecular patterns (DAMPs) or alarmins, i.e. the genetic material of the dead cells, proteins or carbohydrates released outside the cell. etc. [5] Adaptive immunity consists of lymphocytes, including T cells and B cells, that act in a specific response to the type of pathogen that enters the body or vaccines produced from germs or components of that type of germ. When the same pathogen enters the body again, the body responds in 2 types of specific immunity: cell-mediated immunity. Cell-mediated immunity through the activity of specific T cells and antibody or humoral immunity from the activity of specific B cells which produce a specific type of antibody called antibody to neutralize the pathogen. The mechanism of action of the immune system relies on cellular functions in both innate and adaptive immunity that are linked to stimulate each other's responses.

To prevent infection, immunity is to be stimulated with vaccines. Vaccines are biological preparation produced from microorganisms or microbial toxins that can stimulate the body's immune system to fight infection when microbes enter the body. Thus, for people who have been vaccinated, the body's immune system is stimulated in order to fight various infections or if illness occurs. The symptoms of the disease are less severe because the body is immunized by vaccination, an active immunization method. This can take several weeks to months in order to build immunity to prevent disease sufficiently. Types of vaccines are divided into several categories according to the method of vaccine production, such as inactivated vaccines, live vaccines, vaccines produced from pathogen toxins [6]. The trends in mortality and incidence of many infectious diseases are greatly reduced [7], particularly smallpox, diphtheria, pertussis, tetanus, poliomyelitis, measles. Measles, rubella, mumps, and Haemophilus influenzae indicate that vaccines are effective against these infectious diseases but if stopped to measure the scene, it may cause the epidemic of disease again.

Vaccines are therefore the most effective way to boost immunity to control and prevent serious communicable diseases that may affect public health around the world. In Thailand, the results of the vaccine prophylaxis in countries around the world show that Thailand has been quite successful by providing basic vaccines to the population covering more than 90% of the target audience. This has greatly reduced vaccine-preventable diseases in immunization programs. Therefore, it is the most effective and cost-effective method for vaccination to boost immunity. [8] At present, the development of vaccines in Thailand has made great progress. The government has supported the basic vaccination to promote the immune system in a timely and effective manner. More than 90% of people are vaccinated in the public health service system. The main goal of the expansion of immunization is to protect people from diseases that can be prevented by vaccines as much as possible. A key approach towards that goal is to increase the vaccine type, expanding the coverage of vaccination in the target population to get the most out of the day for disease prevention and control by increasing the target audience of vaccine recipients and increasing the coverage of vaccination in the target group [9]. The Ministry of Public Health has put the quality and appropriate vaccines into the immunization program to serve the people especially those in early childhood that should be fully vaccinated as scheduled.

When there is an epidemic, Schools are one of the fastest spreading sources of infection. In the case of schools in Bangkok that have students and staff infected with more than 700 people [10] including other schools in provincial areas [11] due to the general classroom which is a crowded place, for example, a classroom of about 40-50 students, cafeteria, restroom, and where the students come together in an educational institution to do various activities together and take more risk to be exposed to disease or spread easily and making this age at risk of viral infection. For this reason, it may be a risk group to carry the infection of COVID-19 [12]. The objective of this study is to assess the cognition of high school students on immunizations and vaccines because this is important which affects both short-term and long-term health behaviors.

2. OBJECTIVE

1 to assess immune system and vaccine knowledge

Methods

This was a cross-sectional observational study. An online questionnaire was purposely developed and made available through Google Forms between 10 April and 10 September 2022. Grade 10-12 students who could access the internet were eligible and we were invited to participate in the study. The invitation was sent to social media groups used by people so they all receive the invitations. In the invitation had information about the objectives of the study as well as the ethical guarantee of confidentiality and anonymity in the data collected as stated in the informed consent were explained. Participation was completely free and voluntary, and no personal data were collected from any participant.

Instrument

The questionnaire was developed based on a literature review including (1) information provided by and guideline from the Health Authorities (Ministry of Public Health Thailand and World Health Organization) regarding COVID-19 and (2) studies already performed on the same topic where several common items were used to assess each of the dimensions analyzed in this study. The proposed items were then grouped, and redundant items were removed.

A preliminary version of the instrument was reviewed by three experts to validate its content. A pretest was then performed with a small sample of people to test for comprehension and difficulty. All the questions remained without modifications. The psychometric characteristics of the questionnaire were tested, as described in the statistical analysis subsection.

The final version of the questionnaire contained 33 questions, 6 about socio demographic data (gender, class level, study program, parent occupation, monthly household income, channel received information about immune system and vaccine and 17 questions were to assess level of immune system and vaccine knowledge.

Immune system and Vaccine related knowledge: this scale consisted of 17 questions related to Immune system and Vaccine related knowledge. The participants were asked to choose only one correct answer for choices

(A, B, C, and D). One point was assigned to each correct answer while providing an incorrect answer received 0 points. The sum of all items was made; hence higher scores corresponding to a higher level of knowledge. The score varies from 0 to 17, greater than or equal to 14 as a good level, greater than 10 but less than 13 as a moderate level, and less than 10 as a poor level.

Statistical analysis

The analysis was performed using SPSS version 26. The descriptive analyses were presented in absolute (n) and relative (%) frequencies, mean (M) and standard deviations (SD). To assess the differences between the outcome variables (knowledge) and the sociodemographic characteristics, considering the sample size, independent t-tests, and the ANOVA were used, as appropriate. The correlations between the outcomes of the study were calculated by Pearson's correlation. Lastly, a generalized linear model was calculated to determine the predictive variables of the preventive behaviors. Exp (B) and the respective 95% confidence intervals (95% IC) were presented. Statistical significance was defined as $p < 0.05$.

Ethical Consideration

This research uses an anonymous data collection method to collect data from Thai people who could access the internet, by using Google form. The invitation was sent by email to the social media groups of each province. 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 participant.

3. RESULT

214 students participated in this study; 64 (29.9%) males and 150 (70%) females. Most participants were grade 12 students (n=129, 56.1%), grade 11 (n=75, 35%) and grade 10 (n=19, 8.9%). Majority of participants enrolled in Maths-Science program (n=118, 87.9%), Maths-Language (n=12, 5.6%), Maths-Arts (n=10, 4.7%) and others program (n=4, 1.9%). Most participants whose parents worked as employee were 27.6% (n=59), followed by 54% (n=54) worked as a business owner, 18.2% (n=39) worked as a freelance, 21.2% (n=24) worked as others than choices provided, 9.3% (n=20) worked as a teacher, and 8.4% (n=18) worked in health science. For monthly household income, majority of participants' household income were in range between 40,001-80,000Baht (n=57, 26.6%), followed by 20,001-40,000Baht (n=54, 25.2%), 80,001-150,000Baht (n=43, 21.1%), >150,000Baht (n=35, 16.4%), and <20,000Baht (n=25, 11.7%). Most participants received information about immune system and vaccine from social media (n=110, 51.9%), followed by from school (n=44, 20.6%), from parents (n=42, 19.6%), from official news (n=14, 6.5%) and from when visit a doctor (n=4, 1.9%).

Variable	N (%)	Immunization and Vaccine Knowledge Range 1-17 M (SD)
Gender		
Male	64 (29.9)	10.91 (2.85)
Female	150 (70.1)	11.52 (2.20)
Class Level		
Grade 10	19 (8.9)	10.42 (2.63)
Grade 11	75 (35.0)	11.08 (2.79)
Grade 12	129 (56.1)	11.64 (2.09)
Study Program		

Math-Science	188 (87.9)	11.48 (2.43)
Math-Art	10 (4.7)	10.70 (1.70)
Math-Language	12 (5.6)	10.75 (2.09)
Others	4 (1.9)	8.00 (4.00)
Parent Occupation		
Health Science	18 (8.4)	12.67 (2.63)
Employees	59 (27.6)	11.58 (2.05)
Teacher	20 (9.3)	11.40 (2.58)
Business Owner	54 (25.2)	11.26 (2.49)
Freelance	39 (18.2)	11.12 (2.40)
Others	24 (21.2)	10.21 (2.57)
Household Income per month		
<20,000	25 (11.7)	10.28 (2.28)
20,001-40,000	54 (25.2)	11.00 (2.21)
40,001-80,000	57 (26.6)	11.46 (2.88)
80,001-150,000	43 (21.1)	11.53 (2.22)
>150,000	35 (16.4)	12.17 (2.04)
Received information about Immune system and Vaccine knowledge		
School	44 (20.6)	10.63 (2.56)
Parents	42 (19.6)	11.52 (2.26)
Social Media	110 (51.9)	11.41 (2.42)
Visiting doctors	4 (1.9)	13.00 (1.54)
Official news	14 (6.5)	11.92 (2.43)
Total	214	11.34 (2.43)

4. DISCUSSION

The survey was responded from 214 high school students, the majority of participants were female (n=150, 70.1%). Most participants studied in grade 12 (n=129, 56.1%). Participants enrolled most in the Math-Science program (n=188, 87.9%). Parents of most participants worked as an employee (n=59, 27.6%) and the majority of monthly household income was 40,001-80,000 Baht (n=57, 26.6%). Participants learned about immunization and vaccine knowledge from social media (n=110, 51.9%).

From the assessment of basic immunization and vaccine knowledge among participants, the average knowledge about immunization and vaccine knowledge score was at a moderate level (M=11.34, SD=2.43). Female participants showed a higher knowledge score (M=11.52, SD=2.20) than male participants' (M=10.91,

SD=2.85). Grade 12 participants showed the highest average knowledge score ($M=11.64$, $SD=2.09$) among other classes. Participants who enrolled in the Math-Science program had the highest average knowledge score ($M=11.48$, $SD=2.43$). Participants whose parents worked in Health Science revealed the highest average knowledge score ($M=12.67$, $SD=2.63$) and the monthly household income group of <150,000 showed the highest average knowledge score ($M=12.17$, $SD=2.04$). Participants who learned about immune system and vaccine knowledge from doctors they visited for treatment revealed the highest knowledge score ($M=13.00$, $SD=1.54$).

Participants had a moderate knowledge about immunization and vaccines, it may be because this knowledge was included in the Math-science program of Thailand formal education system, which most participants enrolled in this program for their high schools. However, what had been taught at school were at a basic level, most participants showed a moderate average knowledge score. Although this study was conducted during 2022 when COVID-19 has spread all over the world for years [13], immunization and vaccine knowledge should have been extensively educated to all, most high school students were more attentive to their school than other things. This findings was consistency with a study conducted by Sujimon Mungkalarungsi and et al. that health knowledge of most high school students were at a moderate level [14]. Female participants showed a higher average score about immunization and vaccines than male students', this could because being female pays more attention to health than being male, this study was inline with Stefan Ek's [15]. Grade 12 students showed the highest average score among other classes, it may be because grade 12 had learned the most compared to other classes. As well as students who enrolled in the Math-Science program, they had the highest average knowledge score about immunization and vaccines, this could be because they learned from science subjects at their schools. Participants whose parents worked in the health science field showed the highest average knowledge score, this may be because they learned about immunization and vaccines from their parents who process this kind of knowledge better than other work fields. Participants who belonged to a more than 150,000 income group showed the highest average knowledge score, it could be because this high earning income group could access various kinds of media or sources of information so that they had the opportunity to learn more information about immunization and vaccine knowledge. The result showed that the most effective source of information about immunization and vaccines were from learning from doctors who know best in this matter than any other.

Napapha Prayoonwong and et al. [16] conducted a study, during 2019, to assess immunization knowledge among 216 mothers in U-Thong district, Suphanburi Province, Thailand and found that most participants had a moderate level of knowledge regarding immunization and vaccine. Kanittha Chuenjai and Butaga Punturaumporn [17] conducted a study about factor affecting the decision to vaccinate against Coronavirus of the population in Bangkok, found that motivation to prevent disease factors, threat perception from being infected with the disease and effectiveness of vaccine were factors affecting decision to vaccinate against COVID-19 among participants. This finding showed that fear was one factor which drove people to get vaccinated whereas knowledge about immunization and vaccines would drive people to get vaccinated in the sense of prevention.

5. LIMITATION

Because the focus of the study population is high school students, thus the level of tested knowledge is basic for the population. As a result, the knowledge of the students may not be able to be measured relative to the actual standards. And the study conducted using google form, some students could have searched information form a website prior to selecting the answer.

6. CONCLUSION

A total of 214 high school students participated in this study, the majority of participants were female ($n=150$, 70.1%). Most participants studied in grade 12 ($n=129$, 56.1%). Participants enrolled most in the Math-Science program ($n=188$, 87.9%). Parents of most participants worked as an employee ($n=59$, 27.6%) and the majority of monthly household income was 40,001-80,000 Baht ($n=57$, 26.6%). Participants learned about immunization and vaccine knowledge from social media ($n=110$, 51.9%). From the assessment of basic immunization and vaccine knowledge among participants, the average knowledge about immunization and vaccine knowledge score was at a moderate level ($M=11.34$, $SD=2.43$). Female participants showed a higher knowledge score ($M=11.52$, $SD=2.20$) than male participants' ($M=10.91$, $SD=2.85$). Grade 12 participants showed the highest average

knowledge score ($M=11.64$, $SD=2.09$) among other classes. Participants who enrolled in the Math-Science program had the highest average knowledge score ($M=11.48$, $SD=2.43$). Participants whose parents worked in Health Science revealed the highest average knowledge score ($M=12.67$, $SD=2.63$) and the monthly household income group of $<150,000$ showed the highest average knowledge score ($M=12.17$, $SD=2.04$). Participants who learned about immune system and vaccine knowledge from doctors they visited for treatment revealed the highest knowledge score ($M=13.00$, $SD=1.54$).

REFERENCES

1. Learning Organization. Covid-19 Outbreak. Kogpho Subdistrict Administrative Organization [online]. 2021 [Accessed on 1st August 2022]. Available at: <http://www.kogpho.go.th/event-7.html>
2. Covid 19 and epidemiology. Impact on economy, trade, work. Kasetsart University [online]. 2019 [Accessed on 1st August 2022]. Available at: <https://learningcovid.ku.ac.th/course/?c=7&l=2>
3. Carfi A, Bernabei R, Landi F, Gemelli Against C-P-ACSG. Persistent symptoms in patients after Acute COVID-19. JAMA [online]. 2020 [Accessed on 1st August 2022]. Available at: 2020;324(6):603–05.<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7349096/>
4. Cupaioli FA, Zucca FA, Boraschi D, Zecca L. Engineered nanoparticles. How brain friendly is this new guest? Prog Neurobiol 2014; 119-120: 20-38.
5. Nace G, Evankovich J, Eid R, Tsung A. Dendritic cells and damage-associated molecular patterns: endogenous danger signals linking innate and adaptive immunity. J Innate Immun 2012; 4: 6-15.
6. Wichaphat Thananon. How do vaccines work in our bodies? Faculty of Medicine Ramathibodi Hospital Mahidol University [online]. 2022 [Accessed on 1st August 2022]. Available at :<https://www.rama.mahidol.ac.th/atrama/issue044/rama-rdu>
7. O'Hagan DT, Rappuoli R, The safety of vaccines. Drug Discov Today 2004; 9(19): 846-54.
8. National Institute of Vaccines. National agenda on vaccines. Bangkok: Basic Gear 2011
9. Bureau of Communicable Diseases. Vaccines and immunization textbooks, 2013. (3rd edition). Bangkok: Suan Sunandha Rajabhat University. (In Thai) 2015.
10. Bangkok Cristain Collage. More than 700 people infected with covids. Announcement to close for 9 days. Daily News Online [online]. 2022 [Accessed on 1st August 2022]. Available at :<https://www.dailynews.co.th/news/1227184/>
11. Editorial Board The Standard Team. Collect the school cluster after 3 weeks of On-site semester. The Standard stan up for the people [online]. 2021 [Accessed on 1st August 2022]. Available at :<https://thestandard.co/covid-19-clusters-in-schools/>
12. Jintapa benchamas, Natnapa Heebkaew Padchasuwan. Factors related to Covid-19 Preventive Behavior among Secondary Students Kalasinpittayasan School Muang District Kalasin Province. Daan Health Research and Development Journal Nakhon Ratchasima Provincial Public Health Office [online]. 2021 [Accessed on 1st August 2022]. Available at :<https://he02.tci-thaijo.org/index.php/journalkorat/article/view/251066/174223>
13. WHO Health Emergency. WHO Coronavirus (COVID-19) Dashboard. WHO Health Emergency Dashboard WHO (COVID-19) Homepage [online]. 2021 [Accessed on 1st August 2022]. Available at: https://covid19.who.int/?adgroupsurvey={adgroupsurvey}&gclid=Cj0KCQjw7KqZBhCBARIsAI-FTKIBL5v4KwHSZmF92BZa3iJazdRRQiISu2es6c2NeErFTKxMJQZ99AsaAmEGEALw_wcB
14. Sujimon Mungkalarungsi, Kanokorn Tangjongrach, Pondwith Sooparichthiros, Alan Limprasert, Krittiya Eamsawat, Intouch Khieosiri, Nolphawat Ratanavilai. Intention to vaccinate against COVID-19 of high school students aged 16-18 years

old in Thailand: Cross sectional online survey. Institute for urban disease control and prevention JOURNAL [online]. 2018 [Accessed on 1st August 2022]. Available at :<https://he01.tci-thaijo.org/index.php/iudcJ/article/view/250828/172223>

15. Stefan Ek. Gender differences in health information behaviour: a Finnish population-based survey. Health Promotion International [online]. 2015 [Accessed on 1st August 2022] 2015;30: 736–745 Available at :<https://academic.oup.com/heapro/article/30/3/736/620016>

16. Napapha Prayurung, Marut Phuphaniad. Factors Influencing the Immunization Fully Criteria of Childhood in Krachan Sub-district, U-Thong District, Suphan Buri Province. Thai Journal of Public Health and Health Sciences [online]. 2019 [Accessed on 1st August 2022] 2019;2:2651-1711 Available at :<https://he02.tci-thaijo.org/index.php/tjph/article/download/181906/152502/716272>

17. Khanittha Chuenchai, Butka Panturaumporn. Factors affecting the decision to vaccinate against the Coronavirus (Covid-19) of the population in Bangkok. [online]. 2021 [Accessed on 1st August 2022]. Available at :<https://mmm.ru.ac.th/MMM/IS/twin-9/6214154037.pdf>