

Knowledge, attitudes, and preventive behaviors toward pathogens transmission: A study among Grade 10–12 students of Mahidol University International Demonstration School at Nakhon Pathom

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ABSTRACT

Background: It is important for humans to protect themselves from the pathogens because when there are pathogens inside the bodies, it means that our bodies will be weaker which results in inability to work. Getting infected by a disease does not only cause the problems to the individual but it also results in affecting the life of a whole human population. First of all, effective infection prevention will help minimize the risk of infection transmission between people. One of the largest causes of this transmission is pandemic disease. Pandemics disease is widely spread all over the world. This would lead to economic, social, and political disruption. **Objective:** The purpose of this study was to assess knowledge, attitudes, and behavior about pathogens among high school students. **Materials and Methods:** The study was conducted during January 2021–April 2021, all students and teachers from Mahidol University International Demonstration School were invited to participate in completing an online questionnaire. A total of 213 students participated. Differences between outcomes and sociodemographics were analyzed through independent t-test and the ANOVA. A generalized linear model was calculated to determine the predictive variables of preventive behaviors. **Results:** Students revealed low knowledge on preventing transmission of pathogens, scored 2.07 (SD = 1.12) points in a total of 5 points, good attitude toward preventive behavior, 10.75 in a total of 15 questions (SD = 1.67), and low preventive behavior by scoring the average score of 14.55 (SD = 2.32) out of 20 questions. From Pearson's correlation efficient test, the finding indicated that knowledge about pathogens prevention and the preventive behavior has no correlation ($P = 0.01$). The attitude toward preventive behaviors of pathogens either has no correlation with the preventive behaviors ($P = 0.01$). The knowledge about pathogens prevention had positive correlation with the attitude toward pathogens prevention ($r = 0.213$, $P = 0.01$). Statistically tested by generalized linear regression model, knowledge about pathogens prevention, and attitude toward preventive behavior cannot predict the adoption of those preventive behaviors. **Conclusion:** This study provides useful data to plan health education training about transmission of pathogens among high school students. The consistency in knowledge and attitude training by schools in preventive campaigns is essential to promote good preventive behaviors.

KEY WORDS: Hygienic Behavior; Pathogen Transmission; High School Students

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INTRODUCTION

It is important for humans to protect themselves from the pathogens because when there are pathogens inside the bodies, it means that our bodies will be weaker which results in inability to work. Getting infected by a disease does not only cause the problems to the individual but it also results

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in affecting the life of a whole human population. First of all, effective infection prevention will help minimize the risk of infection transmission between people. One of the largest causes of this transmission is pandemic disease. Pandemics disease is widely spread all over the world. This would lead to economic, social, and political disruption.^[1-7]

There are many aspects to look upon the reasons why it is important to prevent infection transmission. However, if we take all the aspects into consideration, we can conclude that it will help protect social welfare.

The infectious transmission is when the infection is transferred from person to person. The infection is caused by a pathogen which is an organism such as virus, bacteria, fungi, and parasite that can cause diseases. Most of the time infectious diseases are passed on from person-to-person or direct contact, but there is also a situation where people can get infected from contaminated food or objects in the environment. This is called indirect contact.

Some examples of infectious disease are COVID-19. This type of disease is viral infection. You need to directly contact the person with this virus for the virus to be transmitted.^[8] Next, food poisoning is caused by bacteria. It occurs when consuming contaminated food inside the body, the bacteria enter the body and infect the body.^[9] There are ways to prevent infectious pathogens. Before pathogens enter the body, getting the vaccine can reduce the chance of getting that disease because your body is already familiar with the pathogens and produces antibodies against it.^[10]

Transmission of infectious pathogens resulting from the agent leaves its reservoir (host) through a portal of exit by mode of transmission and enters through the portal of entry to infect the susceptible host. This sequence is called “The Chain of Infection.” There are 6 points in the chain of infection where they can be broken to stop the germ infecting another person. The chains include; the infectious agent, reservoir, portal of exit, mode of transmission, portal of entry, and susceptible host. The best way to stop the spreading of germs is by interrupting the chain at any link.^[6]

The best way to stop the spreading of germs is by interrupting the chain at any link. Initially, ways to break the first link which is “infectious agent” are by diagnosis and treatment, and antimicrobial stewardship. For reservoirs, the best ways are by cleaning, disinfection, sterilization, infection prevention policies, and pest control. Portal of exit is broken by hand hygiene, personal protective equipment, control of aerosols and splatter, respiratory etiquette, and waste disposal. Mode of transmission is broken by hand hygiene, personal protective equipment, food safety, cleaning, disinfection, sterilization, and isolation. Portal of entry is broken by hand hygiene, personal protective equipment, personal hygiene, first aid, and removal of catheters and tubes. And finally,

susceptible hosts are broken by immunizations, treatment of underlying disease, health insurance, and patient education.^[7]

MATERIALS AND METHODS

The study is mixed research, both quantitative and qualitative researches that study a group of students in Grade 10–12 of Mahidol University International Demonstration School in Nakhon Pathom, Thailand, and teachers at the schools which involves developing a survey and interviewing representatives. We did the survey online using Google Forms and the form was sent out to all Mahidol University International Demonstration School, Bangkok, Thailand, students on January 20, 2021. The survey was voluntary and 213 responses were received.

Instruments

The survey for quantitative research was created based on three aspects in the following: Their background information including their gender, grade level and their study program, their knowledge and understanding, and their attitudes toward the prevention of pathogen transmission.

A preliminary draft of the survey was reviewed by the head of the department of “Infection Prevention and Control” of a public hospital in Thailand. The revisions were seen as appropriate.

The final draft of this survey contained 15 questions; three about demographic data, five about knowledge and understanding about pathogens, three about attitudes toward preventing the spread of pathogens, and four questions about behavior toward preventing the spread of pathogens.

Demographic data

The responses to the questions include grade level, study program, and gender.

Knowledge and understanding

The questions consist of three multiselect questions, one multiple-choice question, and one true-or-false question. Each correct answer is worth 1 point. The sum of all responses indicates the knowledge of pathogens of each individual, in which higher scores indicate more knowledge.

Attitudes toward the spreading of pathogens

There are two responses in the format 5-point linear scales (from 1 – never to 5 – always) and one multiselect question for each individual to answer. The responses to the questions consisted of individual’s concern for the spreading of pathogens. A multiselect question is based on a person’s motivation to prevent the transmission of pathogens. The sum of all the responses indicates the attitudes of each individual

toward preventing the spread of pathogens with higher scores indicating more positive attitudes.

Behavior toward preventing the spread of pathogens

Four of the responses are in the format of 5-point linear scale (from 1 – never to 5 – always). The responses of the 5-point linear scale questions are assigned numbers as selected. The sum of all the responses correlates with more preventive behaviors.

Ethical Consideration

This study is a research based on the information collected from the students at Mahidol University International Demonstration School. The information was collected anonymously using Google from the survey on Google Forms sending through social media groups which is a closed group. Before the participants entered this research, everyone was informed about the purposes of this study and processes of collecting data. The author acknowledges all the participants for contributing to the questionnaire for this study. The participants can withdraw themselves from this study at any time. The collected information is kept confidential.

RESULTS

This study consisted of a total of 213 Mahidol University International Demonstration School, Nakhon Pathom, Thailand, students. The demographic data of the sample are presented in Table 1. Most participants were female ($n = 136$, 76.84%) and followed by 74 male students (41.81%). Most were students of grade level 11 ($n = 97$, 54.80%). Sixty-seven students (37.85%) and 49 students (27.68%) are in Grade 10 and 12, respectively. The major studying programs of the participants are non-science programs ($n = 110$,

62.15%) and the minor group is the one studying in science programs ($n = 103$, 58.19%).

In regard to the knowledge and understanding about pathogens prevention, the average score of students was 2.07 out of 5 (SD = 1.12). Female students got a higher score (mean = 2.09, SD = 1.08) than male students (mean = 2.05, SD = 1.2). Grade 12 students gained the highest mean score at 2.22 (SD = 1.31), then Grade 10 students (mean = 2.05) and Grade 11 students (mean = 2.02) with the same standard deviation at 1.07, respectively. The science major students gained more scores (mean = 2.3, SD = 1.13) than the non-science major student (mean = 1.87, SD = 1.08). For the attitude toward following pathogens prevention guidelines, it leaned toward the preventive behavior at an average score of 10.75 out of 15 (SD = 1.67). In the section attitude toward following pathogens prevention guidelines, male students tended to gain more attitude scores (mean = 10.93, SD = 1.69) than female students. Grade 10, 11, and 12 students had the mean score of 10.66 (SD = 1.65), 9.16 (SD = 1.91), and 8.6 (SD = 2.48), respectively. The science major students gained more scores (mean = 10.78, SD = 1.48) than the non-science major student (mean = 10.72, SD = 1.83). In regard to preventive behavior, the average score was 14.55 out of 20 (SD = 2.32). The difference between the mean score of females (mean = 14.56, SD = 2.178) and males students (mean = 14.54, SD = 2.178) was 0.02. Grade 11 students (mean = 15.06, SD = 2.81) earned the highest score followed by Grade 11 students (mean = 14, SD = 2.71) and then Grade 10 students (mean = 14.22, SD = 1.93). The science major students gained more scores (mean = 14.78, SD = 2.15) than the non-science major student (mean = 14.38, SD = 2.47).

The analysis of the correlation between the data of each section shows the following: There were no statistically significant correlations between the preventive behaviors and other variables [Table 2].

Table 1: Differences in outcomes according to the sociodemographic characteristic of participants ($n=213$)

Sociodemographic	<i>n</i>	(%)	Knowledge about pathogens prevention (range 0–5)		Attitude toward preventive behavior (range 5–15)		Preventive behavior (range 1–20)	
			Mean	SD	Mean	SD	Mean	SD
			2.07	1.12	10.75	1.67	14.55	2.32
Gender								
Male	74	41.81	2.05	1.2	10.93	1.69	14.54	2.178
Female	139	76.84	2.09	1.08	10.66	1.65	14.56	2.41
Grade level								
Grade 10	67	37.85	2.05	1.07	10.66	1.65	14.22	1.93
Grade 11	97	54.80	2.02	1.07	9.16	1.91	15.06	2.28
Grade 12	49	27.68	2.22	1.31	8.6	2.48	14.00	2.71
Study program								
Science	103	58.19	2.3	1.13	10.78	1.48	14.73	2.15
Non-science	110	62.15	1.87	1.08	10.72	1.83	14.38	2.47

SD: Sociodemographic

Table 2: Pearson’s correlation coefficient between study’s outcomes

Variable	Knowledge about transmission of pathogens prevention	Attitudes toward preventing transmission of pathogens	Preventive behavior
Knowledge about transmission of pathogens prevention	1	0.213**	0.032
Attitudes toward preventing transmission of pathogens	0.213**	1	0.009
Preventive behavior	0.032	0.009	1

**Correlation is significant at 0.01

Referring to Table 3, the generalized linear model shows that different levels of knowledge about pathogen spreading prevention and different levels of attitude toward preventing pathogen spreading do not affect the preventive behavior of individuals. Summary of in-depth interviews of different studies are compared in Table 4.

DISCUSSION

The students revealed a medium level of knowledge about pathogen spreading prevention while the teachers understood that the students had good knowledge about pathogen spreading prevention. This may be because the students did not know or understand about pathogen spreading prevention. Although this group of students came from a well to do family, they have accessibility to a variety of media, online media.

Biomed Res Int. (2018) studied impact of health education on knowledge and behaviors toward infectious diseases among students in Gansu Province, China. They found out that gender and education level also affected scores of student behaviors toward infectious disease ($P < 0.001$). This result is not consistent with the result we got from Mahidol University International Demonstration School, because our finding about the relationship of gender and education level with student behaviors does not relate with each other which means that it does not show any relationship.

Our limitation includes the COVID-19 pandemic, due to COVID-19, we must conduct the survey online as well as interview teachers online. Therefore, it took us longer to get the accurate information or thoughts of students and teachers. The strength of this study is that even though our hypothesis about factors affecting preventive behavior is wrong, because gender, grade level, study program, attitude, and knowledge do not affect the preventive behavior of students, we could find the reasons to back up our results. Those reasons include the rebellious behavior of teenagers as well as our interviews from teachers.

Table 3: Generalized linear model predicting behavior

Generalized linear model predicting behavior	B	SE	P-value	Beta	95% IC	
					Lower value	Upper value
Intercept	14.93	1.371	0.000		23.79	32.57
Knowledge about pathogens spreading prevention	0.034	0.149	0.819	0.017	-1.47	0.26
Attitude toward preventive behavior	0.521	0.238	0.093	0.006	0.05	0.99

R=0.082, R-square=0.07

The results regarding the knowledge about pathogens prevention of Mahidol University International Demonstration School’s students in Grade 10–12 had a low score. This may be due to the fact that the students’ knowledge was only on the basic level. Deeper level of knowledge in the prevention of pathogens, the students did not seem to have knowledge regarding this topic. The reason behind this could be that they had not learned about this topic at all, because biology was required as a core subject only in Grade 10. Later, in Grade 11 and 12, biology or subjects related to biology was a part of elective courses that students could choose.

Referring to the attitude following pathogens prevention guidelines of Mahidol University International Demonstration School’s students in Grade 10–12, the average score was at medium level. Even though their attitude toward prevention of the disease was medium, they did not care about the prevention enough to do it. Naturally, during the period of adolescence, people will be more rebellious compared to other stages in life.^[2] The desire to be independent will be very high during this time. Teens will not enjoy doing things they are forced to do. They will make impulsive and reckless decisions because of their carelessness.^[3]

For the levels of preventive behaviors, the students’ preventive behavior is medium. This can be interpreted that the preventive behavior did not affect or was affected by genders, grade level, study program, knowledge, and attitude. This can be explained by the theory of teenagers’ behavior and environmental behavior. First, teen rebellion might be one of the reasons for this result. Teen rebellion is an act of independence and disobedience to advice.^[5] This will lead to defiance to rules and instructions given to them. They will start wanting to do things in their own way and most of the time, they will make an impulsive decision because of their lack of logic. Furthermore, the environment can cause changes in teenagers behavior as well. Based on the theory of Ajzen and Fishbein, people with different norms and beliefs may have different beliefs on the outcome of performing a behavior which then determine intention and behavior of the individuals.^[1]

Table 4: In-depth interview result

In-depth interview questions	
What is your opinion on the knowledge of MUIDS students about the transmission of pathogens?	Matt Forgy (April 20, 2021) gave his opinion that the students overall are probably better informed than I was at their age because of access to videos on the internet regarding infectious disease. Natamon Rittilertnapa (April 20, 2021) mentioned that MUIDS students know about the transmission of infection pathogens. All students are aware of how dangerous and serious it is. Natawut Kalayanamit (April 20, 2021) gave the opinion that most of the students know a lot about the current pandemic situation, where it started, what are the symptoms, and how it spreads
What is your opinion on MUIDS students' behavior on the prevention of pathogens transmission?	Matt Forgy (April 20, 2021) commented that the students could be better about preventing the spread of pathogens. In the bathrooms, he often saw students leave without using soap to wash their hands. He had reminded the students that they should have been using soap to protect themselves and others. Natamon Rittilertnapa (April 20, 2021) commented that the students still lack prevention. She pointed out the situation during break time, the students like to stay together as a group and they always shared their food. Natawut Kalayanamit (April 20, 2021) observed that the students' behavior was the problem. There was a disconnect between the knowledge they have and their actions. Many of them do not seem to understand the seriousness of the pandemic because, for the most part until recently, it was perceived as something far away from them. Students were often seen to not be wearing masks, sharing food and utensils, meeting outside of school, etc.
What is your opinion on the general behavior of MUIDS students that relates to the prevention of pathogens transmission?	Matt Forgy (April 20, 2021) observed that the students could do better in preventing pathogens transmission such as wearing their masks. Natamon Rittilertnapa (April 20, 2021) gave the opinion that the school needed to reinforce students to practice social distancing Natawut Kalayanamit (April 20, 2021) mentioned that most of the students did not seem to understand the seriousness of the pandemic because it was perceived as something far away from them

RECOMMENDATION

Few suggestions we would like to suggest is first, health education should be provided more consistently for the students, especially about infectious pathogens and its hazardous effect to create awareness in students. Based on^[1] behavioral change model, it shows that if people were better informed and have more knowledge, they will become more aware of the situation and this would motivate them to take action and start to prevent themselves as well as people around them from infectious pathogens.

Second, strict rules and regulations should be set up. This is because rules will help guide students' action to the appropriate and desired results. Furthermore, rules will promote physical and emotional safety. However, laws alone

won't be effective if social norms' actions are opposite to the laws. Social norms are not written rules and it can vary over time. Based on Jackson, the William D. Eberle Professor of Economics (Laws may be ineffective if they do not reflect social norms), the laws that go against norms will not be considered and used, in the meantime, laws that affect behavior change can change norms overtime. Therefore, strict laws must be made along with motivating students to have good attitudes to perform the best behavior, which will be discussed in the following paragraph.

Finally, students must be informed more about having a good attitude. Because having good attitudes will lead to good intentions to act and better behavior. Furthermore, having good attitudes can build positive social norms toward preventing infectious pathogens. To have good attitudes, students must have good knowledge plus regulations. This infers that knowledge or regulations alone is insufficient to persuade individuals to be responsible.

CONCLUSION

This study revealed the low knowledge level preventive behavior in transmission of pathogens among all grade students in Mahidol University Demonstration School and indicated a positive attitude toward preventive knowledge. However, the other factors do not show any correlation with each other. Moreover, it reinforces that knowledge does not affect the preventive behaviors of students and that having positive attitudes toward preventive behavior does not affect one another. Thus, attitude toward preventive behaviors is the major predictive factor of having preventive behavior. Therefore, to promote preventive behaviors, we should focus more on improving students' attitude by creating strict laws and regulations, providing more health education to students and building good attitudes inside students' subconscious.

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