Research Article

Knowledge, attitude, and drug resistance preventive behavior among Thai people:A cross-sectional online study in Thailand

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Receiving: July 19, 2021; **Accepted:** August 13, 2021

ABSTRACT

Background: Many Thai people have misconceptions about antibiotics, such as an understanding that antibiotics are an anti-inflammatory drug. It has led to the misconception that the use of this drug will make existing disease heals faster because the drug is going to treat or cure inflammation. Many people do not know that bacteria can develop itself to resist antibiotics, therefore, they misunderstand that antibiotics can relieve pain, reduce fever which can lead to misuse of antibiotics. Drug resistance related knowledge and antibiotic misuse affect the development of drug-resistant strains. There are more than 38,000 deaths each year in Thailand which cost economical loss which accounted for 0.6% of gross domestic product. **Objectives:** The purpose of this study was to assess drug resistance related knowledge, attitude toward drug resistance prevention, and drug resistance preventive behaviors among Thai people. **Materials and Methods:** An online cross-sectional survey was conducted among 1123 Thai people who could access the internet. Drug resistance related knowledge, attitude, and behavior toward drug resistance prevention was assessed. Differences between outcomes and sociodemographic were analyzed through independent *t*-test, ANOVA.A generalized linear model was calculated to determine the predictive variables of preventive behaviors. **Results:** Participants revealed moderate knowledge about drug resistance, correctly answering 9.86 (SD = 1.65) questions in a total of 15 and favorable attitudes toward preventive behaviors (M = 24.78, SD = 3.25). Participants reported on average 45.92 (SD = 7.25) of 12 behaviors in terms of always engaging in prevention, which was considered to be moderate. Females presented a higher level of knowledge, more positive attitude, and engaged in more preventive behaviors than males. Age, educational attainment, level of income, and knowledge about drug resistance had a negative correlation with preventive behavior toward drug resistance (r = –0.109**, r = –0.081**, r = –0.197**, and –0.111**, $P< 0.01$). Having a positive attitude toward preventive behavior of drug resistance predicted the adoption of those preventive behaviors (Exp (β) = 0.83, 95% CI: 0.046–0.325, $P < 0.01$). **Conclusion:** Participants had a moderate level of knowledge on drug resistance, favorable attitude toward drug resistance prevention, and moderate level of preventive behaviors. Participants who had a busy lifestyle were more likely to compromise preventive behavior toward drug resistance, mostly in the 30–50 age group, even though their level of attitude toward prevention was at a good level. From the study, it

Access this article online	
Website: http://www.ijmsph.com	Quick Response code
DOI:10.5455/ijmsph.2021.08081202113082021	

is clear that prioritizing public knowledge on drug resistance is strongly and urgently advised to heighten attitudes toward drug resistance prevention to improve drug preventive behavior. More importantly, long-term systematic interventions and solutions should be considered, such as integrating, improving, and stressing the education on the issue of drug resistance.

KEY WORDS: Drug Resistance; Preventive Behavior; Anti-drug Resistance Behavior

INTRODUCTION

Antimicrobial resistance (AMR) is a global health and development threat. The WHO has declared that AMR is one of the top 10 global public health threats facing humanity. Drug-resistant pathogens are primarily caused by the misuse and overuse of antimicrobials. The cost of AMR to the economy is substantial. Along with death and disability, long-term illness results in longer hospital stays, more expensive medicines, and financial challenges for those affected. Drug resistance caused by: (1) Bacterial factors, bacteria are organisms that have evolved overtime. Their main function is to reproduce, grow, and spread quickly and efficiently, therefore, bacteria adapt to the environment and change in a way that allows them to survive. (2) Incorrect drug use behavior in humans and animals which is a catalyst for more drug-resistant bacteria.[1] Drug-resistant bacteria can spread rapidly in a variety of places, including communities, food sources, health-care facilities, and the environment (e.g., soil and water).[2] Drug-resistant bacteria are spread by contact. Humans may have been hospitalized with antibiotics and then brought with them antibiotic-resistant bacteria. These can spread to other patients with unclean hands or contaminated objects. Patients who may have bacterial antibiotic resistance are eventually sent home and can spread these drug-resistant infections to other people.[3]

Many Thai people have misconceptions about antibiotics, such as an understanding that antibiotics are an anti-inflammatory drug. It has led to the misconception that the use of this drug will make existing disease heals faster because the drug is going to treat or cure inflammation. Antibiotics are antibacterial drugs, for example, penicillin, amoxicillin, and tetracycline, which have no anti-inflammatory effect.[4] Many people do not know that bacteria can develop itself to resist antibiotics, therefore, they misunderstand that antibiotics can relieve pain, reduce fever which can lead to misuse of antibiotics. These behaviors include not following the instructions given by the physician, failing to take medicine according to the prescription, not finishing the medicine course once feeling relieved from sickness, taking leftover medicine from previous illness, and buying antibiotics from the drug store by themselves.[5] Drug resistance related knowledge and antibiotic misuse affects the development of drug-resistant strains. There are more than 38,000 deaths each year in Thailand which cost economical loss which accounted for 0.6% of gross domestic product.[6]

The study aimed to identify the drug resistance related knowledge, attitude toward drug resistance prevention, and preventive behavior toward drug resistance among Thai people and to analyze the predictors of the adoption of those preventive behaviors.

MATERIALS AND METHODS

Participants and Procedure

Based on the KAB Model,[7] this was a cross-sectional observational study among provinces in Thailand which cover local social media groups in Bangkok, Pathumthani, Samutprakarn, Nonthaburi, Nakhon Pathom, Kanchanaburi, and Sakaeo. Co-researcher based locations were selected as research area. An online questionnaire was purposely developed and made available through Google Forms between May and July 2021. All Thai people who can access the internet and use social media were eligible and were invited to participate in the study. The invitation was sent to various local social media groups. Members of local social media groups (Facebook, Line, and Instagram) had access to what was being promoted in the groups, so they all received an invitation. On this invitation, information about the objectives of the study as well as the ethical guarantee of confidentiality and anonymity of 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.A total of 1123 people of an unknown total population participated in the study.

Instrument

The questionnaire was developed based on a literature review including (1) drug resistance, AMR, antibiotic resistance, mode of transmission, preventive guideline by the WHO, CDC, and European Centre of Disease Prevention and Control and (2) the previous studies 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 which was originally in Thai and was reviewed by three infection control specialists from a public hospital to validate its content.A pre-test was then performed on a small sample of people to test for comprehension and difficulty. All the questions were without

any modifications. The psychometric characteristics of the questionnaire were tested, as described in the statistical analysis subsection. The final version of the questionnaire contained 44 questions: Seven on sociodemographic data (gender, age, educational level, occupation, monthly, congenital disease, and recent antibiotic use) and the remaining items were divided into three sections.

The scale used to assess drug resistance related knowledge consisted of 15 questions. The participants were asked to choose a correct answer from choices of 4. One point was assigned to each correct answer, while an incorrect answer received zero points. The sum of all items was calculated with higher scores corresponding to a higher level of knowledge. Cronbach's alpha for the scale calculated with the sample of this study was acceptable ($\alpha = 0.8$).

For attitude toward drug resistance preventive behavior, the scale was composed of 10 items, and response categories consisted of a 5-point Likert scale (from 1 – disagree to 3 – agree) with the highest score corresponding to more positive attitudes toward drug resistance prevention. Some items on the scale were inverted for the analysis. The coefficient of internal consistency was acceptable ($\alpha = 1.0$).A sum of all the items was added to obtain a score ranging from 10 to 30 where a higher value corresponded to a more positive attitude toward drug resistance prevention.

The scale for drug resistance preventive behavior referring to the number of preventive behaviors adopted included 12 items following antibiotic use guidelines and hygienic behavior preventing spreading of pathogens. The data analysis consisted of 12 items. Each item was answered using a 5-point scale (from 1 – never to 5 – always), with 1 point assigned to each behavior that was always practiced. The number of behaviors practiced was added up.A high score on this scale indicated good preventive behaviors, ranging from 12 to 60. The internal consistency of the scale was $\alpha = 1.0$.

Statistical Analysis

The analysis was performed using SPSS version 26. To analyze psychometric characteristics of the scales, an exploratory factor analysis, using principal component analysis with varimax rotation, was carried out. Reliability was analyzed through the calculation of item-total correlation coefficients and Cronbach's alpha (α) for the scales of the questionnaire. The descriptive analysis was presented in absolute (n) and relative (%) frequencies, mean (M), and standard deviations (SD). To assess the differences between the outcome variables (knowledge about drug resistance, attitude toward drug resistance prevention, and drug resistance preventive behaviors) and the sociodemographic characteristics, covering the sample size, independent *t*-test, and the ANOVA were used as appropriate. The correlations between the outcomes of the study were calculated by Pearson's correlation. Finally, a generalized linear model was calculated to determine the predictive variables of the preventive behaviors. Exp (β) and the respective 95% confidence intervals (95% IC) were presented. Statistical significance was defined as $P< 0.05$.

Ethical Considerations

This research used an anonymous data collection method to collect data from people who can access the internet and belong to social media groups in Thailand, using Google Forms. The invitation was sent to various social media groups. On these invitations, information about the study's objectives and ethical guarantee of confidentiality and anonymity of 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.

RESULTS

This study comprised a total of 1123 participants. The sociodemographic characteristics of the sample are presented in Table 1. Most participants were female (*n* = 827, 73.6%). The largest number of participants belonged to the 41–50 group (*n* = 337, 30%) followed by the 15–20 age group (*n* = 327, 29.1%) and groups of 31–40 years old (*n* = 118, 16.7%), respectively. The majority of participants graduated from high school or equivalent (*n* = 441, 39.3%) followed by bachelor degree graduates (*n* = 368, 32.8%).A total of 694 participants (61.8%) earned less than 30,000 baht followed by 208 participants (18.5%) earning more than 50,000 baht per month. Most participants were students (*n* = 352, 31.3%) followed by business owners (*n* = 225, 20%) and private company employees (*n* = 205, 18.3%). Predominantly, the participants reported using antibiotics within 6 months (*n* = 291, 25.9%) followed by having no experience of using antibiotics before (*n* = 276, 24.6%) and not remembering when their last antibiotics usage was *n* = 328, 29.2%, accordingly. About 75.9% (*n* = 852) of participants reported no congenital disease. Participants showed a moderate level of knowledge on drug resistance with an average score of 9.68 from a total of 15. Female participants had a higher average score (9.87, SD = 1.66) than male (9.84, SD = 1.63). The age group which had the highest average knowledge score was 41–50 years old (10, SD = 1.6) followed by 15–20 group (9.83, SD = 1.67) and group of 50 years old and above (9.79, SD = 1.65). Participants who graduated with a master degree or above had the highest knowledge average score (10.30, SD = 1.48) followed by the bachelor degree group (10.14, SD = 1.60). Participants who earned more than 50,000 baht per month showed the highest knowledge average score (10.52, SD = 1.41) followed by the income group of 30,001–50,000 baht (9.89, SD = 1.68). Participants who work for the government or state enterprises showed the highest knowledge score on drug resistance (10.14,

Table 1: Differences in outcomes according to the sociodemographic characteristics of participants (*n*=1,123)

Sociodemographic characteristic	n	%	Drug resistance related knowledge 1–15 *n*, SD		Attitude toward drug resistance prevention 10–30 *n*, SD		Drug resistance preventive behavior 12–60 *n*, SD	
Gender								
Male	296	26.4	9.84	1.63	24.31	3.36	45.14	7.36
Female	827	73.6	9.87	1.66	24.95	3.19	46.20	7.20
Age								
15–20	327	29.1	9.83	1.67	24.41	3.19	47.63	7.39
21–30	103	9.2	9.52	1.79	24.37	3.60	45.50	8.14
31–40	118	16.7	9.92	1.62	25.46	3.07	44.73	6.97
41–50	337	30.0	10.00	1.60	24.8	3.22	44.86	6.82
>50	168	15.0	9.79	1.65	24.98	3.28	46.31	6.67
Educational attainment								
High school or equivalent	441	39.3	9.63	1.68	24.09	3.24	47.77	6.79
Bachelor degree	368	32.8	10.14	1.60	25.45	3.07	44.09	7.36
Master degree and above	189	16.8	10.30	1.48	26.08	2.87	43.64	7.1
Others	125	11.1	9.2	1.61	23.38	3.24	48.26	6.35
Monthly income (baht)								
<30,000	694	61.8	9.66	1.66	24.32	3.21	46.95	7.14
30,001–50,000	221	19.7	9.89	1.68	25.31	3.07	45.14	6.91
>50,000	208	18.5	10.52	1.41	25.78	3.27	43.31	7.27
Occupation								
Office worker	205	18.3	10.11	1.60	25.77	3.03	43.06	6.60
Civil servant	144	12.8	10.14	1.71	25.43	3.14	46.67	7.72
Business owner	225	20.0	9.84	1.55	24.34	3.21	45.4	7.05
Students	352	31.3	9.80	1.68	24.39	3.23	47.56	7.28
Freelance	197	17.5	9.55	1.68	24.49	3.36	46.03	6.85
Having congenital disease								
No	852	75.9	9.83	1.65	24.74	3.25	45.94	7.27
Yes	271	24.1	9.98	1.63	24.93	3.24	45.85	7.23
Antibiotic use								
Never	276	24.6	9.35	1.87	23.86	3.26	46.78	7.65
Within 6 months	291	25.9	10.08	1.43	25.01	3.24	45.24	7.24
Within 1 year	148	13.2	10.12	1.51	25.69	2.85	44.68	7.34
Within 2 years	80	7.1	10.54	1.65	25.64	3.03	45.63	6.35
Do not remember	328	29.2	9.82	1.59	24.75	3.28	46.44	7.00
Total	1123	100	9.86	1.65	24.78	3.25	45.92	7.25

SD = 1.71) followed by private company employees (10.11, SD = 1.60) and business owner group (9.84, SD = 1.55), respectively. Participants who reported having congenital disease showed higher knowledge scores (9.98, SD = 1.63) than groups of participants who reported not having any (9.83, 1.65). The largest number of participants reported using antibiotics within the past 2 years also had the highest knowledge score (10.54, SD = 1.65) followed by group of participant reported using antibiotics within the last year (10.12, SD = 1.15) and those who reported using antibiotics within 6 months (10.08, SD = 1.43). Regarding attitude toward drug resistance preventive behavior, participants were at a good level 24.31 (SD = 3.36). Female participants had a higher attitude's score (24.95, SD = 3.19) than male participants (24.31, SD = 3.36). Age group of 31–40 had the highest score on attitude toward drug resistance prevention (25.46, SD = 3.07) followed by the age group of more than 50 (24.98, SD = 3.28) and the age group of 41–50 (24.8, SD = 3.22), respectively. On an educational level, participants who graduated with a master or above had the highest attitude's score (26.08, SD = 2.87) followed by the bachelor degree group (25.45, SD = 3.07). Income groups of more than 50,000 baht per month showed the highest attitude scores (25.78, SD = 3.27) followed by 30,001–50,000 baht

groups (25.31, SD = 3.07). In terms of occupation, it was shown that the office worker group had the highest score on attitude toward prevention (25.77, SD = 3.03) followed by the civil servant and state enterprise group (24.43, SD = 3.14), freelance and others groups (24.49, SD = 3.36). Participants who reported congenital disease had a higher attitude score (24.74, SD = 3.25) than those who did not (24.93, SD = 3.24). Those participants who had used antibiotics within 1 year had the highest attitude score (25.67, SD = 2.85) followed by those who had used antibiotics within 2 years (25.64, SD = 3.03) and within 6 months (25.01, SD = 3.24). Concerning the 12 drug resistance preventive behaviors, participants reported always engaging in, on an average 45.92 (SD = 7.25). Female participants showed higher drug resistance preventive behavior scores (46.20, SD = 7.20) than male participants (45.14, SD = 7.36). Age groups of 15–20 and 21–30 showed the highest drug resistance preventive score of 47.63 (SD = 7.39) and 45.50 (SD = 8.14), accordingly, followed by groups of more than 50 which had an average score of 46.31 (SD = 6.67). For educational attainment, group of participants who reported graduating from "others than choices provided" and high school had the highest average preventive behavior scores of 48.16 (SD = 6.35) and 47.77 (SD = 6.79) followed by participants group who reported graduating from a bachelor degree (44.09, SD = 7.36). Participants who earned less than 30,000 baht per month had the highest preventive behavior score (46.95, SD = 7.14) followed by 30,001–50,000 baht per month (45.14, SD = 6.91). Results from analyzing participants' occupation found that participants who were students had the highest preventive score (47.56, SD = 7.28) followed by civil servant and state enterprise groups (46.67, SD = 7.72) and freelancers and others (46.03, SD = 6.85). Participants who reported not having congenital disease had a higher behavior score (45.94, SD = 7.27) than who reported having one (45.85, D = 7.23). Participants who reported never using antibiotics had the highest preventive behavior scores (46.78, SD = 7.65) followed by not remembering when was the last time they used antibiotics (46.44, SD = 7.00) and reported using antibiotics within 2 years (46.44, SD = 6.35).

The analysis of the correlation between the data of each section showed the following: There were negative and statistically significant correlations between preventive behaviors and age (r = –0.109**, $P< 0.01$); educational attainment (r = –0.081**, $P<$–0.01); income (r=–0.197**, $P<0.01$); and knowledge on drug resistance (r = –0.111**, $P< 0.01$). Positive correlation between age and educational attainment (r = –0.528**, $P< 0.01$); age and income (r = –0.453**, $P< 0.01$); educational attainment and income (r = –0.343**, $P< 0.01$); income and knowledge on drug resistance (r = –0.193**, $P< 0.01$); and income and attitude toward drug resistance prevention (r = –0.186**, $P< 0.01$) was present [Table 2].

The analysis of the generalized linear model showed that attitudes toward preventive behaviors and participant occupation had a significant effect on the preventive behaviors. Therefore, attitudes toward preventive behaviors (Exp (β) = 0.083, 95% CI: 0.046–0.325, $P< 0.01$) and occupation (Exp (β)=0.078, 95% CI: 0.076–0.762, $P< 0.01$) can predict preventive behaviors of drug resistance [Table 3].

DISCUSSION

For this cross-sectional observation online survey, there were 1123 participants. Most participants had a moderate average score on drug resistance preventive behavior and knowledge on drug resistance while presenting a good level of attitude toward drug resistance prevention. It was detected from a statistical analysis that there was a negative correlation between drug resistance preventive behaviors and age, educational attainment, income, and knowledge on drug resistance. It could be explained that the older, the higher education attained, the more income and the more level of drug resistance knowledge participants obtained, the lower level of drug resistance prevention the participant showed, and vice versa. This may be because people who earned more than 50,000 baht monthly were the busiest with their jobs or other responsibilities among other income groups. Therefore, regarding their usage of antibiotics based on the guidelines, they were likely to do it at a modest level. Moreover, not

Table 2: Pearson's correlation coefficient between the study outcomes

Variables	Age	Educational attainment	Level of income	Drug-resistant related knowledge	Attitude toward drug-resistant prevention	Drug-resistant preventive behavior
Age	1	0.528**	0.453**	0.030	0.067*	–0.109*
Educational attainment	0.528**	1	0.343**	0.011	0.052	–0.081**
Level of income	0.453**	0.343**	1	0.193**	0.186**	–0.197**
Drug-resistant related knowledge	0.030	0.011	0.193**	1	0.364**	–0.111**
Attitude toward drug-resistant prevention	0.067*	0.052	0.186**	0.364**	1	0.010
Drug-resistant preventive behavior	–0.109**	–0.081**	–0.197**	–0.111**	0.010	1

**Correlation is significant at the 0.01 level. *Correlation is significant at the 0.05 level

Table 3: Generalized linear model predicting preventive behavior of drug resistance (*n*=1,123)

Variables	B	S.E.	Exp (β)	*t*	*P*-value	IC95% lower	IC95% upper
Age	–0.108	0.182	–0.022	–0.595	0.552	–0.466	0.249
Gender	0.819	0.484	0.050	1.691	0.091	–0.131	0.249
Educational attainment	–0.082	0.251	–0.011	–0.326	0.745	–0.575	0.411
Occupation	0.419	0.175	0.078	2.395	0.017	0.076	0.762
Income	–1.329	0.333	–0.144	–3.994	0.000	–1.981	–0.676
Congenital disease	0.354	0.503	0.021	0.704	0.482	–0.633	1.341
Antibiotic use	0.044	0.135	0.010	0.328	0.743	–0.221	0.310
Drug resistance related knowledge	–0.463	0.139	–0.105	–3.331	0.001	–0.736	–0.190
Attitude toward drug resistance prevention	0.186	0.071	.083	2.615	0.009	0.046	0.325

Multiple R=0.243, R^2=0.059, Adj R^2=0.052, S.E.=7.066, F=7.787, P<0.01

following the recommendation would not present any immediate effects, making it less urgent or important to do so. People have a tendency to react to urgent issues or activities that demand immediate attention, while neglecting acting on important issues that lead to achieving desirable outcomes.[8] While, other participants who earned less than 50,000 baht per month tended to have a less busy life and were more likely to have better drug resistance prevention than those who were busier. On the other hand, positive correlation between age and educational attainment; age and income; educational attainment and income; income and knowledge on drug resistance; and income and attitude toward drug resistance prevention was statistically significant. The study revealed that participants who had the highest preventive behavior were those who rarely took antibiotics and most of them were one without congenital disease. This may be due to having a good level of health which resulted in having a lesser need of using any medicine.

A study conducted by Tonginta[9] on drug resistance preventive behavior of a group of teacher in Bangkok found that the majority of the participants graduated with at least a bachelor degree had moderate level of drug resistance knowledge, while having favorable level of attitude toward drug resistance preventive behavior and a good level of drug resistance preventive practice. Ratanathaworn[10] conducted a study on factors influencing drug resistance preventive behavior among Grade 10–12 students of Triamudomsuksa School in Bangkok found that they had a good level of drug resistance knowledge, favorable attitude toward preventive behavior and had good average score for drug resistance preventive behavior. However, this sample group of students had busy schedules at school and extra tuition after school, so when they felt sick, some of them chose to buy medicine from a pharmacy instead of going to see a doctor which could be more time consuming. Therefore, people who had both good knowledge and attitude toward drug resistance but had busy schedules were more likely to compromise following drug resistance guidelines. While, knowledge and understanding about drug resistance may have been acquired outside academic context such as receiving advice from a doctor, pharmacist, or from various media or news where the level of education attainment had no relationship with the level of drug resistance knowledge. Having received instructions on how to use drugs properly were found to have a significant impact on antibiotic use behaviors in a study by Monkolchaiphak *et al*.[11] that were conducted on the consumers' knowledge and behaviors in using antibiotics at community drug stores in Pathumthani. From the study, the sample group had shown a good level of knowledge about antibiotic use. Although the issue of drug resistance is very important and poses a serious threat to modern medicine, when compared to a pandemic, it receives much less attention and awareness. People are much more alert when it comes to seeking an update on the latter. To make the issue of drug resistance more present in society, a more fundamental and systematic intervention is required such as integrating it as part of an educational curriculum. In this study, attitude toward drug resistance preventive behavior was a predictive factor for the adoption of preventive behavior consistent with Ratanathaworn and Tonginta's study, while knowledge about drug resistance influenced the level of attitude toward drug resistance prevention. Thus, to increase the level of awareness and encourage positive drug resistance preventive behavior among participants, public knowledge campaigns should be promoted thoroughly.

Limitation of the Study

The study was conducted during the COVID-19 pandemic, methods of collecting data were an online survey where only people who had access to the internet could participate in this study. During the COVID-19 pandemic, there were many people who were economically affected while having many unpaid bills which could limit them to participate in this study. Most participants were aware of hygiene practices such as washing hands during the pandemic, therefore, this could result in higher scores on hygienic-related questions.

CONCLUSION

Participants had a moderate level of knowledge on drug resistance, favorable attitude toward drug resistance

prevention, and moderate level of preventive behaviors. Participants who had a busy lifestyle were more likely to compromise preventive behavior toward drug resistance, mostly in the 30–50 age group, even though their level of attitude toward prevention was at a good level. From the study, it is clear that prioritizing public knowledge on drug resistance is strongly and urgently advised to heighten attitudes toward drug resistance prevention to improve drug preventive behavior. More importantly, long-term interventions and solutions should be considered, such as integrating, improving, and stressing the education on the issue of drug resistance.

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How to cite this article: Mungkalarungsi S, Tangjonrach K, Chaemnapa D, Wimuttigosol P, Buttamee N, Anakewat J, *et al*. Knowledge, attitude, and drug resistance preventive behavior among Thai people:A cross-sectional online study in Thailand. Int J Med Sci Public Health 2021;10(2):205-211.

Source of Support: Nil, **Conflicts of Interest**: None declared.