ORIGINAL ARTICLE

Predictive factors of COVID-19 self-test kit usage among undergraduate students in Thailand: a cross-sectional survey

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ABSTRACT

The COVID-19 self-test kit plays a pivotal role in public health by identifying active infections and enhancing individuals' access to testing. Its rapid results enable early detection of positive cases, contributing significantly to the control of disease transmission. This cross-sectional survey aimed to assess the knowledge, attitude, and behavior in using the COVID-19 self-test kit and explored demographic characteristics, knowledge, and attitude as factors predicting COVID-19 self-test kit usage behavior among undergraduate students of the Faculty of Physical Education, Sports, and Health. The participants were selected by quota sampling technique. Data were collected from February 1 to 25, 2023. A total of 446 participants completed an anonymous online questionnaire voluntarily. Descriptive statistics, one-way analysis of variance and multiple stepwise linear regression were utilized for data analysis, using SPSS at a significance level of 0.05. The findings showed a high level of knowledge (71.3%) in using COVID-19 self-test kits, moderate scores in behavior (71.7%) and a neutral attitude (54.3%) towards their usage. Gender, year of study, department of study, and underlying disease exhibited noteworthy disparities in knowledge scores (all $p<0.05$). Similarly, gender, number of COVID-19 infections, and vaccination status were associated with attitudes (all $p < 0.001$). Furthermore, the department of study emerged as a significant factor influencing behavioral aspects ($p = 0.013$). Attitude ($\beta = 0.427$, 95% CI [0.455, 0.685], $p < 0.001$), being from the Department of Public Health ($\beta = 0.199$, 95% CI [2.388, 5.771], $p < 0.001$), knowledge ($\beta = 0.168$, 95% CI [0.316, 0.962], $p < 0.001$), being gender diverse ($\beta = -0.089$, 95% CI [-5.428, -0.157], $p = 0.038$), and being infected with COVID-19 twice ($\beta = -0.083$, 95% CI [-6.632, -0.015], $p = 0.049$) were significant predictors of COVID-19 self-test kit usage behavior. The identified predictors provide practical guidance for educational institutions and health authorities.

Key words:
attitude; behavior; COVID-19 self-test kit; knowledge; undergraduate student

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INTRODUCTION

Throughout the COVID-19 pandemic in Thailand, spanning the period from 2019 to 2021, individuals adhered to lockdown measures to protect themselves from the virus. In the early part of 2022, with improvements in the situation, people gradually resumed aspects of their normal lives, marking a shift towards semi-normalcy compared to during the period of the initial COVID-19 outbreak. Consequently, increased numbers of newly infected individuals were identified although the numbers of people with severe symptoms and fatalities decreased. However, there was insufficient use of COVID-19 self-test kits among cases where individuals experienced few or no symptoms. Furthermore, the incidence of cluster outbreaks was on the rise, particularly in restaurants, pubs, and bars, where many establishments failed to adhere to the prescribed measures.[1]

According to the Communicable Disease Law B.E. 2558 in Thailand, the Ministry of Public Health downgraded COVID-19 from a dangerous communicable disease to an endemic disease. This change was published in the Royal Gazette and became effective on October 1, 2022. With the COVID-19 situation improving, the measures were modified so that people could live in a balanced manner, considering health, security, social, and economic factors. The revised measures also advised those living with a mild or asymptomatic case of COVID-19 to continue practicing social isolation, mask-wearing, handwashing, and self-testing with antigen test kits (ATKs) to avoid contracting or spreading the virus.[2]

ATKs, sometimes referred to as rapid antigen test kits (RATs), utilize immunochromatography with antibodies on nitrocellulose membranes. They are valuable for diagnosing COVID-19 by detecting the nucleocapsid protein of the virus, with similar successful strategies seen in HIV, malaria, and influenza testing. This cost-effective and straightforward test yields quick results for point-of-care testing, ensuring individual accessibility and contributing to early infection control during a pandemic.[3] The World Health Organization (WHO)[4] recommended a minimum performance requirement for RATs, namely, at least 80% sensitivity and 97% specificity, leading to widespread global use.[5-7] From a public health standpoint, RATs are pivotal in the screening process, pinpointing active COVID-19 infections and improving individuals' testing accessibility, which is crucial for COVID-19 pandemic control.[8-9] The economic value of COVID-19 screening programs has been assessed, revealing significant benefits outweighing costs, particularly when confirmatory testing is employed to enhance adherence and reduce unnecessary quarantines.[10] In a study conducted at Chonburi Hospital in Thailand involving 1,290 patients, RATs and RT-PCR tests were compared. The results revealed that RATs demonstrated high accuracy in diagnosing COVID-19 infections during active surveillance.[11]

Knowledge, attitude, and behavior (KAB) surveys play a vital role in gathering information for public health program planning. Positive attitudes contribute to good practices, and knowledge can shape attitudes, impacting behavior.[12] Attitudes toward a behavior are influenced by personal beliefs about the behavior's outcomes. Positive attitudes arise when individuals believe that behavior leads to desirable outcomes, while negative attitudes result from beliefs in undesirable outcomes.[13] Bevan et al. conducted a rapid scoping review on KAB regarding COVID-19 testing and found widespread acceptance of testing due to social solidarity despite barriers like eligibility, uncertainty, and access challenges. Testing is seen as a social process linked with contact tracing, influencing daily lives and

relationships.[14] Gu and Zhu discovered that Chinese residents had moderate knowledge of COVID-19 self-test kits, influenced by factors like gender and social status. Improving access to education and refining test kits is crucial, alongside maximizing technology use for accurate diagnosis and interpretation.[15] Marinos et al. studied Greek students' COVID-19 self-testing compliance, mandated for school reopening by the Greek Government. They found high awareness and strong compliance among students performing self-testing twice weekly. However, older adolescents showed lower compliance, indicating the need for tailored interventions to improve acceptability.[16]

As the COVID-19 situation improved, Srinakharinwirot University (SWU), Thailand, reintroduced onsite teaching in February 2022. In response, the Faculty of Physical Education, Sports, and Health mandated weekly COVID-19 risk assessments and self-screening using ATKs to prevent a further COVID-19 outbreak. During this period, students' utilization of ATKs was a novel experience, potentially affecting preventive measures if they lacked the necessary KAB towards using ATKs. Furthermore, there had been no studies directly addressing the KAB associated with ATK usage. Therefore, this study aimed to comprehend the levels of KAB concerning ATK usage and identify factors predicting COVID-19 self-test kit behavior among undergraduate students of the Faculty of Physical Education, Sports, and Health, SWU, Thailand. This study will benefit SWU by providing insights into students' KAB regarding COVID-19 self-testing. This information can inform targeted interventions to enhance compliance and promote a safer campus environment. Additionally, it ensures alignment with government mandates, contributing to the university's reputation for responsible public health management.

METHODS

Population and sample

A population of 1,717 undergraduate students were available during the 2022 academic year of the faculty, which comprises five departments, which are those of (1) physical education, (2) health education, (3) recreation, (4) sports sciences, and (5) public health. The Raosoft sample size calculator was utilized[17], and considering a confidence level of 95%, a 4% margin of error, a proportion of 50%, the calculated sample size was 445 participants. Accounting for a 10% attrition rate[18], the total number of target participants was 490.

We employed a quota sampling technique to recruit students from the five departments, with each department aiming to collect responses from 98 students. We created an anonymous online questionnaire using Google Forms. Quick response (QR) code links were distributed to groups on the Facebook social media platform and LINE communication platform, allowing students to access the information freely between 1 and 25 February 2023 (the Google Forms system closed on February 25). To ensure the validity of responses, only students with a .edu email provided by SWU (...@swu.ac.th) could participate in the survey. Out of the 490 participants, a final sample of 446 students returned questionnaires, corresponding to a response rate of 91.02%.

Instrument

The questionnaire was developed based on a comprehensive literature review. The preliminary draft underwent refinement through discussions with three academic experts specializing in questionnaire design, resulting in minor linguistic adjustments to align with the context of undergraduate students. To

ensure content validity, applicability, and clarity within the study setting, the draft questionnaire underwent review by three experts. Additionally, a pilot test was conducted with 30 students from the Faculty of Physical Education, Sports, and Health at SWU, including six students from each department. Within each department, two students from the first year, two from the second year, and one from the third and fourth years were selected to participate. The logical thinking and suitability of these students were checked, and they were asked to provide feedback on clarity and ease of understanding. Remarkably, no comments were received from the students. It was important to note that responses from the pilot testing were not included in the study dataset. Content validity values of knowledge, attitude, and behavior (KAB) were 0.80, 0.79, and 0.82 respectively. Moreover, KAB reliability values were 0.813, 0.731, and 0.813, respectively.

The final questionnaire comprised four sections. The first section included seven questions on students' personal information, covering gender, age, year of study, department of study, underlying disease, number of COVID-19 infections, and number of COVID-19 vaccinations.

The second part consisted of 17 knowledge-based questions on using COVID-19 ATKs. These questions assessed participants' knowledge of various aspects of this topic, such as the purpose of testing, accuracy, approval by the Thai FDA, and sensitivity. Additionally, questions covered the expiry date of the test kits, symptoms indicative of testing, specimen type, proper route and positioning for specimen collection, usage steps, interpretation of test results, and disposal methods for used test kits. For example, participants were asked about the purpose of using ATKs; the purpose of using ATKs is for screening or surveillance in individuals with few or no symptoms, providing rapid test results. Furthermore, the questions explored the accuracy of ATKs; the duration of the test affects its accuracy, particularly during the early stages of infection, when the pathogen count is low, increasing the likelihood of false negative results.

The third section, comprising 14 questions, delved into respondents' attitudes toward using COVID-19 ATKs. The questionnaire structure encompassed aspects such as accessibility, logistics, pricing, perceived benefits, effectiveness of specimen types, confidence in usage, trustworthiness of the test kits, convenience for health monitoring, and privacy considerations associated with conducting tests at home or in dormitories. The questions included the following: Do you think ATKs are readily available for purchase at convenience stores or pharmacies? Do you think using ATKs for self-testing helps save time and reduce expenses for traveling to medical facilities for testing? Do you think the price of ATKs in the market is reasonable?

The final part, comprising 24 questions, focused on their behaviors regarding the usage of COVID-19 ATKs. These questions covered various aspects, including symptoms prompting testing, testing frequency, activities posing infection risk, prerequisites for purchasing test kits, comprehension of usage guidelines (e.g., checking expiry dates, packaging, and usage steps), adherence to prescribed procedures, specimen collection steps, hand hygiene prior to testing, and proper disposal of used materials. The questions included the following: Do you use an ATK when you suspect you are infected with COVID-19 even if you are asymptomatic? Do you use an ATK after entering crowded places, enclosed spaces, or areas with a high prevalence of COVID-19 transmission? Do you choose to purchase ATKs only from brands that have standards certified by the Food and Drug Administration (FDA).

Knowledge scores were calculated by assigning 1 point to each correct

question, employing three answer options: 'Yes' (assigned a value of 1), 'No' (assigned a value of 0), and 'Don't know' (assigned a value of 0). To measure the attitude variable, responses were rated on a 5-point Likert-type scale, where 1 signified 'strongly disagree,' and 5 'strongly agree.' Similarly, for the behavior variable, a 5-point Likert scale was utilized: 1 = 'never' and 5 = 'always'. The knowledge and behavior related to using ATKs were categorized into three levels: good, moderate, and lacking, while attitude was classified as positive, neutral, and negative. Achieving the good level with a positive attitude required scores of at least 80.0% of the total points available for knowledge, attitude, and behavior combined. The moderate level with a neutral attitude encompassed scores ranging from 50.0% to <80.0%, while the lacking level with a negative attitude included scores less than 50.0% of the total available points[19].

Statistical analysis

Utilizing descriptive statistics, we analyzed demographic characteristics and KAB levels. Mean scores of KAB and demographic features were compared using one-way analysis of variance (ANOVA). Predictors in the regression model encompassed demographic characteristics, knowledge, and attitude towards ATK usage behavior. Dummy variables were created for gender, year of study, department, underlying disease, number of COVID-19 infections, and number of COVID-19 vaccinations, assuming binary values (0 or 1) to indicate the absence or presence of categorical effects on ATK usage behavior[20]. Pearson correlation was used to assess associations between demographics, knowledge, attitude, and ATK usage behavior. Multiple stepwise linear regression was used to predict ATK usage behavior. Analyses were conducted with SPSS software version 26 at a significant level of 0.05.

Ethical approval

This cross-sectional study involved undergraduate students from the Faculty of Physical Education, Sports, and Health, SWU, Thailand. Following the provision of a written explanation of the study, written informed consent was obtained from all participants prior to their participation. The study received approval from the Research and Ethics Committee of SWU (Registration No: SWUEC-308/2565E).

RESULTS

Upon examining the sample of 446 students, the following key demographic characteristics emerged: the sample was predominantly male (48.4%), aged 20-21 years (53.8%), and fourth-year students (30.0%), with a significant representation from the Department of Public Health (29.6%). The majority reported no underlying diseases (87.0%), while 53.4% had experienced a prior COVID-19 infection. Notably, 46.6% had received three vaccine doses, as presented in Table 1.

Table 1. Demographic characteristics of the study participants (n = 446)

Variable	n	%
Gender		
Male	216	48.4
Female	186	41.7
Gender diverse	44	9.9
Age group (years)		
18-19	144	32.3
20-21	240	53.8
> 22	62	13.9
Age (Mean ± SD)	20.22 ± 1.276	
Year of study		
First year	110	24.7
Second year	96	21.5
Third year	106	23.8
Fourth year	134	30.0
Department		
Physical education	92	20.6
Health education	74	16.6
Recreation	78	17.5
Sports sciences	70	15.7
Public health	132	29.6
Underlying disease		
No	388	87.0
Don't know	30	6.7
Yes	28	6.3
Number of COVID-19 infections		
None	178	39.9
One	238	53.4
Two	26	5.8
Three	4	0.9
Number of COVID-19 vaccine doses		
One dose	6	1.3
Two doses	166	37.2
Three doses	208	46.6
Four doses	66	14.8

Table 2 shows that knowledge scores (71.3%) regarding ATK usage were at a good level. However, behavior scores (71.7%) were at moderate levels, and there was a neutral attitude (54.3%) towards using ATKs.

Table 2. Level scores of KAB (n=446)

Level scores	Knowledge	Behavior	Attitude
	Number (%)	Number (%)	Number (%)
Good (≥ 80%)	318 (71.3)	124 (27.8)	-
Moderate (50- <80%)	116 (26.0)	320 (31.7)	-
Lacking (< 50%)	12 (2.7)	2 (0.4)	-
Positive (≥ 80%)	-	-	200 (44.8)
Neutral (50- <80%)	-	-	242 (54.3)
Negative (< 50%)	-	-	4 (0.9)

As outlined in Table 3, one-way ANOVA analysis comparing mean KAB scores with demographic characteristics revealed significant differences. Gender, year of study, department of study, and underlying disease exhibited noteworthy disparities in knowledge scores (all $p < 0.05$). Similarly, gender, number of COVID-19 infections, and vaccination status were associated with attitudes (all $p < 0.001$). Furthermore, the department of study emerged as a significant factor influencing behavioral aspects ($p = 0.013$).

Table 3. Comparison between KAB mean scores and demographic characteristics (n = 446)

Variable	Knowledge		Attitude		Behavior	
	Mean (SD)	F-test	Mean (SD)	F-test	Mean (SD)	F-test
Gender						
Male	13.11 (2.276)	4.105*	51.73 (6.968)	12.884***	90.48 (11.039)	1.555
Female	13.81 (2.518)		51.68 (7.049)		88.84 (7.388)	
Gender diverse	13.59 (2.952)		57.23 (5.184)		89.41 (7.899)	
Age group (years)						
18-19	13.56 (2.906)	0.324	51.99 (6.718)	0.274	88.51 (8.616)	1.692
20-21	13.43 (2.191)		52.28 (7.029)		90.20 (9.220)	
>22	13.26 (2.402)		52.77 (7.795)		90.45 (11.466)	
Year of study						
First year	13.25 (3.212)	6.716***	51.95 (6.714)	0.668	88.87 (8.701)	0.714
Second year	14.29 (1.812)		51.60 (6.449)		89.71 (7.835)	
Third year	13.60 (2.032)		52.89 (6.560)		89.40 (8.020)	
Fourth year	12.88 (2.330)		52.46 (8.001)		90.58 (11.706)	
Department						
Physical education	13.22 (3.425)	8.164***	51.89 (6.401)	0.812	89.09 (8.128)	3.214*
Health education	14.19 (1.653)		52.11 (7.244)		88.70 (8.276)	
Recreation	14.41 (1.819)		52.10 (8.058)		88.62 (7.643)	
Sports sciences	13.23 (2.560)		53.63 (7.086)		88.20 (9.053)	
Public health	12.74 (2.048)		51.94 (6.661)		92.09 (11.383)	

Variable	Knowledge		Attitude		Behavior	
	Mean (SD)	F-test	Mean (SD)	F-test	Mean (SD)	F-test
Underlying disease						
No	13.64 (2.449)	9.406***	52.27 (7.106)	0.642	89.84 (9.107)	0.910
Don't know	12.00 (2.319)		51.13 (5.952)		87.47 (10.827)	
Yes	12.36 (2.129)		53.21 (7.099)		90.07 (11.537)	
Number of COVID-19 infections						
None	13.65 (2.245)	1.517	53.17 (6.818)	5.447**	90.16 (10.067)	1.807
One	13.33 (2.496)		51.16 (7.055)		89.76 (8.873)	
Two	12.92 (3.543)		55.92 (5.748)		87.15 (9.067)	
Three	15.00 (0.000)		52.50 (10.970)		81.50 (6.351)	
Number of COVID-19 vaccine doses						
One dose	12.67 (2.251)	0.879	54.00 (4.472)	8.675***	92.67 (1.862)	1.407
Two doses	13.65 (2.570)		53.75 (6.928)		89.57 (8.386)	
Three doses	13.29 (2.470)		50.48 (7.000)		89.10 (10.472)	
Four doses	13.52 (2.207)		53.91 (6.336)		91.61 (8.376)	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, SD = standard deviation

According to the results of the Pearson correlation analysis presented in Table 4, knowledge and attitude exhibited significant positive correlations with the behavior of using ATKs (r = 0.238 and 0.430, respectively, $p < 0.01$). Positive correlations with knowledge were observed among female, second-year students, and those enrolled in the departments of health education and recreation, as well as individuals without underlying diseases (r = 0.123, 0.179, 0.134, 0.180, and 0.200, respectively, $p < 0.01$).

In contrast, negative correlations with knowledge were found among male, fourth-year students, those in the Department of Public Health, and students who responded, 'don't know' regarding underlying diseases (r = -0.133, -0.151, -0.186, and -0.158, respectively, $p < 0.01$). Students with underlying diseases were also negatively correlated with knowledge (r=-0.115, $p<0.05$). Positive correlations with attitude were found among gender diverse individuals, students who had been infected twice with COVID-19, and those who had received two doses of the COVID-19 vaccine (r = 0.234, 0.130, and 0.164, respectively, $p < 0.01$). Students who had never been infected with COVID-19, and those who received four doses of vaccination were positively related to attitude as well (r=0.106, and r=0.098, respectively, $p<0.05$).

Conversely, students infected with COVID-19 once, and those who received three doses of vaccination exhibited a negative correlation with attitude (r =-0.166, and r=-0.236, respectively, $p < 0.01$). Additionally, enrollment in the Department of Public Health showed a positive correlation with the behavior in using ATKs (r = 0.166, $p < 0.01$).

Table 4. Correlation between demographic characteristics and KAB (n = 446)

Variable	Knowledge	Attitude	Behavior
Knowledge	1		
Attitude	0.246**	1	
Behavior	0.238**	0.430**	1
Gender			
Male (reference variable)	-0.133**	-0.072	0.082
Female	0.123**	-0.069	-0.077
Gender diverse	0.019	0.234**	-0.010
Age group (years)			
18-19 (reference variable)	0.030	-0.026	-0.087
20-21	-0.007	0.004	0.059
>22	-0.031	0.030	0.033
Year of study			
First year (reference variable)	-0.045	-0.025	-0.050
Second year	0.179**	-0.048	0.001
Third year	0.035	0.051	-0.018
Fourth year	-0.151**	0.020	0.062
Department			
Physical education (reference variable)	-0.048	-0.026	-0.033
Health education	0.134**	-0.009	-0.047
Recreation	0.180**	-0.010	-0.053
Sports sciences	-0.038	0.085	-0.069
Public health	-0.186**	-0.029	0.166**
Underlying disease			
No (reference variable)	0.200**	0.006	0.040
Don't know	-0.158**	-0.043	-0.064
Yes	-0.115*	0.035	0.011
Number of COVID-19 infections			
None (reference variable)	0.067	0.106*	0.041
One	-0.052	-0.166**	0.007
Two	-0.053	0.130**	-0.067
Three	0.060	0.003	-0.083
Number of COVID-19 vaccine doses			
One dose (reference variable)	-0.037	0.029	0.037
Two doses	0.063	0.164**	-0.010
Three doses	-0.061	-0.236**	-0.059
Four doses	0.011	0.098*	0.085

*$p < 0.05$, **$p < 0.01$

Table 5 displays the results of multiple stepwise regression analysis, indicating significant predictors of ATK usage behavior among undergraduate students. Attitude (β = 0.427, $p < 0.001$), being from the Department of Public Health (β = 0.199, $p < 0.001$), knowledge (β = 0.168, $p < 0.001$), being gender diverse (β = -0.089, $p = 0.038$), and experiencing COVID-19 infection twice (β = -0.083, $p = 0.049$) emerged as significant predictors. Collectively, these factors explained 25.50% of the variance in the ATK usage behavior (adjusted $R^2 = 0.255$, $F = 31.414$, $p < 0.001$).

The ATK usage behavior increased by a score of 0.570 for each unit increase in attitude (B = 0.570, 95% CI [0.455, 0.685],

$p < 0.001$). Similarly, for each unit increase in knowledge, the ATK usage behavior increased by a score of 0.639 (B = 0.639, 95% CI [0.316, 0.962], $p < 0.001$). Students from the Department of Public Health scored 4.079 points higher in ATK usage behavior compared to students from other departments (B = 4.079, 95% CI [2.388, 5.771], $p < 0.001$). Furthermore, gender diverse students scored 2.793 points lower in ATK usage behavior compared to their female and male counterparts (B = -2.793, 95% CI [-5.428, -0.157], $p = 0.038$). Similarly, students who had experienced two COVID-19 infections scored 3.324 points lower in ATK usage behavior compared to those who had never been infected, had a single infection, and had thrice been infected with COVID-19 (B = -3.324, 95% CI [-6.632, -0.015], $p = 0.049$).

Table 5. Predictive factors influencing ATK usage behavior (n = 446)

Predictive factors	B	SE	Beta (β)	t	*p*-value	95% CI for B	
						Lower Bound	Upper Bound
Constant	50.585	3.311		15.279	<0.001	44.078	57.091
Attitude	0.570	0.058	0.427	9.748	<0.001	0.455	0.685
Department of Public Health	4.079	0.860	0.199	4.741	<0.001	2.388	5.771
Knowledge	0.639	0.164	0.168	3.886	<0.001	0.316	0.962
Gender diverse	-2.793	1.341	-0.089	-2.083	0.038	-5.428	-0.157
Twice infected with COVID-19	-3.324	1.683	-0.083	-1.974	0.049	-6.632	-0.015

Adjusted $R^2 = 0.255$, $F = 31.414$, $p<0.001$
B = unstandardized regression coefficients, SE = standard error, t = t-test, CI = confidence interval

DISCUSSION

Amidst the dynamic landscape of COVID-19, numerous KAB surveys were carried out between 2020 and 2023, primarily focusing on the awareness, acceptance, and accessibility or willingness to use COVID-19 rapid antigen self-tests.[14] In the absence of surveys specifically addressing KAB related to the usage of ATK self-tests, our study represents the first attempt to investigate this topic among university students. We discovered that university students exhibited high knowledge scores regarding ATK usage, consistent with findings by Marinos et al., who noted high awareness and strong compliance among students in conducting COVID-19 self-tests[16]. However, our results contrast with those of Gu and Zhu, who found that Chinese residents had only moderate knowledge of COVID-19 self-test kits.[15] While knowledge scores concerning ATK usage were deemed satisfactory, behavior scores were moderate, and attitudes toward ATK usage were found to be neutral. This indicates a gap between knowledge levels and the actual behavior and attitudes toward ATKs. Within the framework of social cognitive theory (SCT), it is crucial to understand how individual cognition, environment, and behavior interact in ATK usage. When moderate behavior is observed despite high knowledge, SCT-based interventions can enhance self-efficacy by bolstering confidence in ATK usage and result interpretation. Leveraging observational learning to normalize behavior and boost confidence, emphasizing positive outcomes like early COVID-19 detection, and addressing environmental factors such as social norms and misinformation can all promote widespread ATK usage, thereby improving public health outcomes in COVID-19 prevention.[21]

We observed a positive correlation between knowledge and ATK usage

behavior, highlighting the significance of well-informed attitudes in influencing behavior. Notably, demographic characteristics like gender, year of study, department of study, and underlying diseases exhibited significant disparities in knowledge scores. Similarly, gender, number of COVID-19 infections, and vaccination status were associated with attitudes. This finding is consistent with the research presented by Boudaghi and Arabi, which showed a significant relationship between health literacy and health behavior, as well as between attitudes towards COVID-19 and health behaviors among citizens in Ahvaz during the pandemic period.[22] Moreover, Li et al. found disparities in KAB among students of different grades, majors, and genders.[23] This emphasizes the necessity of tailoring educational strategies to address specific knowledge gaps among diverse student groups. Targeted interventions can be designed to ensure widespread understanding, considering the unique backgrounds of the student population.

The study explored the significant role of attitude and knowledge in predicting ATK usage behavior among undergraduate students, emphasizing the central role of attitude as the strongest predictor. This finding aligns with Nam and Pak's research, which indicated that attitudes toward the disease could predict adherence to preventive behaviors among South Korean adults.[24] Positive attitudes, stemming from perceptions of effectiveness, ease of use, and a sense of responsibility for public health, contribute to the dynamic interplay between attitudes and behavior.[25-27]

Drawing on psychological research, the study recognized the complexity of the relationship between attitudes and behavior, which is influenced by factors such as attitude strength, accessibility, and external influences. The theory of planned behavior suggests that behavioral intentions are influenced by three main factors: attitudes toward the behavior, subjective norms (social influences and perceptions), and perceived behavioral control (the individual's perception of their ability to perform the behavior).[28-29] Meanwhile, the cognitive dissonance theory explains the psychological discomfort that arises when individuals hold conflicting beliefs, attitudes, or values. To alleviate this discomfort, people are motivated to change their beliefs or behaviors to restore consistency.[29-30] The understanding of this intricate relationship carries practical implications for psychology, marketing, and public health, guiding the development of interventions that effectively address underlying attitudes.[31]

The study highlighted the significant influence of the Department of Public Health on ATK usage behavior, suggesting the potential efficacy of targeted educational interventions within specific departments. Customizing educational efforts to the unique needs of each department could enhance overall awareness and behavior. Furthermore, the role of academic disciplines in influencing behavioral aspects is evident from the departmental disparities in ATK usage behavior. This implies that discipline-specific training significantly shapes behavior. Further exploration into the mechanisms through which academic disciplines impact behavior could inform targeted interventions and educational strategies.

An unexpected finding surfaced concerning students who had experienced two COVID-19 infections, scoring lower in ATK usage behavior despite the fact they made up a smaller proportion of participants (26 out of 446 participants). This raises the need to consider potential confounding variables that may have contributed to this result or alternative explanations for the result. One possibility is that these students may have developed a sense of immunity or

complacency after experiencing COVID-19 infections, leading to decreased motivation to engage in preventive behaviors such as ATK usage. Additionally, factors such as fatigue from previous infections, differences in perceived susceptibility to reinfection, or variations in adherence to other preventive measures could also have influenced ATK usage behavior. These possibilities are aligned with Patel et al,[32] and Gómez-Gonzales et al[33] who stated that the likelihood of reinfection of COVID-19 depends on several factors, including infection treatment, immunopathogenesis, immune responses, rigorous adherence to appropriate behavior, and prevention strategies. Moreover, Mori et al[34] found that people with a history of COVID-19 were less likely to self-restraint from most social behaviors, and people whose acquaintance had been diagnosed with COVID-19 were significantly more likely to refrain from most social behaviors. However, this finding also suggests potential reluctance influenced by prior experiences or perceptions of testing efficacy. The finding underscores the need for a nuanced understanding of individual experiences and attitudes toward testing, providing a valuable perspective for designing interventions that account for varied experiences and perceptions. This nuanced approach holds the potential to contribute significantly to more effective public health strategies in the context of self-test kit usage among undergraduate students.

LIMITATIONS OF THE STUDY

There are some limitations in our study. We employed convenience sampling, which, while expedient for data collection, may have introduced selection bias. Participants were chosen based on their accessibility and willingness to participate in the survey, potentially leading to a non-representative sample. Those who agreed to participate may have differed systematically from those who did not, impacting the generalizability of the findings. The reliance on participants' self-reports collected at a single point in time may have introduced limitations related to recall bias and the dynamic nature of attitudes and behavior. Participants may have provided responses influenced by the circumstances at that time, potentially not capturing the full range of their experiences or attitudes over time. Furthermore, the cross-sectional survey design limited our ability to explore causality and trends, areas where a longitudinal study would provide valuable insights.

Acknowledging these limitations is crucial for interpreting the study's findings accurately. Future research employing diverse sampling methods and longitudinal designs could further enhance our understanding of the dynamic interplay between knowledge, attitudes, and behavior in the context of self-test kit usage among undergraduate students.

CONCLUSION

The findings revealed a high level of knowledge, moderate scores in behavior, and a neutral attitude towards ATK usage. Knowledge of and attitude toward ATK usage correlated with behavior in using ATK self-tests. Notably, gender, year of study, department of study, and underlying disease showed significant disparities in knowledge scores. Similarly, gender, number of COVID-19 infections, and vaccination status were associated with attitudes. Furthermore, the department of study emerged as a significant factor influencing behavioral aspects. This study highlighted the significance of attitude, being from the Department of Public Health, knowledge, being gender diverse, and being infected twice with COVID-19 as predictors of COVID-19 self-test kit usage behavior among undergraduate students.

Recognizing and addressing disparities in knowledge, acknowledging the impact of personal experiences, and tailoring interventions to specific departments and demographics are pivotal for fostering widespread acceptance and practical application of self-testing measures.

RECOMMENDATIONS

Based on the study's findings, SWU should develop targeted interventions to enhance students' knowledge, attitudes, and behaviors regarding COVID-19 self-testing, ensuring accurate information availability, providing support and resources, and fostering a culture of compliance, thus contributing to a safer campus environment, and reinforcing the university's reputation for responsible public health management. Future research could explore the qualitative aspects of attitudes and behaviors, providing a more comprehensive understanding and guiding the development of targeted interventions. Tailored interventions are crucial to encourage responsible testing practices within this demographic. The identified predictors provide practical guidance for educational institutions and health authorities. Ongoing research is essential to adapt strategies and address emerging challenges in promoting public health practices within academic settings amid the evolving COVID-19 landscape.

CONFLICT OF INTEREST

There are no conflicts of interest to declare.

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