

RESEARCH ARTICLE

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E-Cigarette Use among University Students from One University in Hanoi, Vietnam, and Associated Factors

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Abstract

Objective: Describe the use of e-cigarettes and factors associated with e-cigarette use among university students from one university in Vietnam in 2021. **Methods:** This cross-sectional study was conducted with a total of 554 full-time undergraduate students recruiting for the study. Data was collected using a structured self-administered questionnaire. A logistic regression analysis was performed to identify factors with significant association with students' use of e-cigarettes. **Results:** The study revealed that 13.2% of students were current users. Students who had e-cigarette smokers in the family (aOR=6.1, 95% CI: 2.5-15.4; p<0.001), used traditional cigarettes (aOR=23.6, 95% CI: 10.5-53.4; p<0.001), consumed alcohol (aOR=5, 95%CI: 1.6 – 15.9; p<0.01), were exposed to e-cigarette advertising (aOR=2.6; 95%CI: 1.1-5.9; p<0.01), and had inadequate knowledge about e-cigarettes (aOR=2.2; 95%CI: 1-4.7; p<0.01) were more likely to use e-cigarettes. **Conclusion:** This study updates the status of e-cigarette use among students in one university in Vietnam, thereby suggesting strategies to reduce the use of e-cigarettes among university students.

Keywords: Electronic cigarettes- vaping- university students- Vietnam- associated factors

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Introduction

E-cigarettes (EC), also known as electronic nicotine delivery systems, were originally developed in China in 2003. They have spread globally and are available in many shapes and sizes. Most comprise of three parts: a battery, a heating element, and a place to hold a liquid (CDC). E-cigarettes produce an aerosol by heating a liquid that usually contains nicotine, which is a highly addictive substance. Nicotine can harm adolescent and young adult brain development, as well as cause injuries and other dangerous diseases (CDC). E-cigarettes are marketed through various channels, such as the internet, newspapers/magazines, television/movies and retail stores, as safer products than traditional cigarettes or as medical products and aids to quit smoking (Sobh and Abo-Elkheir, 2016; Shantakumari et al., 2015). With the growing popularity of social networking sites, worldwide awareness and use of ECs have dramatically increased in recent years, especially among youth and young adults (Truth Initiative) (Wulan et al., 2022). The latest National Youth Tobacco Survey conducted in 2020 indicated that EC use among youth in the U.S. has increased dramatically since 2011 3.6 million youth still using ECs at the time of the survey (FDA). Furthermore, disturbingly high rates of frequent and daily EC use (40% of high school users)

implied the strong dependence on nicotine among youth in the U.S (FDA). Recently, ECs have emerged in Vietnam and gradually become a public health threat, especially in metropolises such as Hanoi and Hochiminh City. Vietnam currently does not have any specific legal mechanism to manage the marketing or distribution of ECs, and the latest law on tobacco control in 2012 has not kept up with rapid changes in the tobacco industry. This may increase the risk of obtaining incorrect awareness of ECs, thereby initiating EC use among young people. The results from the Global Adult Tobacco Survey (GATS) conducted in Vietnam in 2015 showed that the prevalence of ever users and current users of ECs were 1.1% and 0.2%, respectively (Ministry of Health of Vietnam, 2016). The National University of Civil Engineering (NUCE) is a public higher-education institution located in Hanoi. Although the university has issued some regulations to limit the use of tobacco, EC and traditional cigarette use among students is still common outside the university's campus. Currently, no study has been conducted to explore the status of EC use among university students in Vietnam in general and at NUCE. Therefore, this study was conducted to describe the use of ECs and factors associated with EC use among university students at NUCE.

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Materials and Methods

Sample population

This cross-sectional study was conducted among students at the NUCE (Hanoi, Vietnam) from November 2020 to May 2021.

Eligible participants included full-time undergraduate students enrolled between 2016 and 2021, who were able to self-administer the structured questionnaires. Participation was completely voluntary. Students who were absent when the survey was administered were not included in this study.

Sample size and sampling

A sample size formula to estimate the one-proportion was used with an absolute precision of 0.06, an anticipated population proportion of 0.5 to acquire the largest sample size and an alpha error of 0.05 (Lwanga et al., 1991). A design effect of 2 was included (Lwanga et al., 1991) to apply the cluster sampling strategy. Therefore, the minimum required sample size included 534 students.

Eligible participants were selected following the cluster sampling method with each class being a cluster. The average number of students in a class was 50 students, hence 12 classes were selected to reach 590 students. The study selected 12 classes of different study majors and enrollment year from the list of classes requiring in-person attendance at the time of data collection in January and February 2021. All students in selected class were invited to join the study. Finally, a total of 554 complete questionnaires were returned and inputted for analysis.

Data collection

Data was collected using a structured self-administered questionnaire. The questionnaire was tested among 10 students who were not included in the actual survey. Several spelling, grammar mistakes and format were fixed before the actual survey.

From the list of 12 classes participating into the study, the researcher contacted the teachers to schedule meetings with students in the classrooms. Questionnaires were distributed to the students present in the classroom at the time of data collection. It took approximately 20 minutes to complete the questionnaire. Investigators were present at the study site to provide necessary explanations about the study and collect the questionnaires. The survey was anonymous and students who did not want to participate in the survey returned a blank form.

Variables

Sociodemographic characteristics included age (in years), gender (male/female), academic result (excellent/good/average/below average), academic year (1st year/2nd year/3rd year/4th year/5th year), having traditional cigarette smokers in the family (yes/no), having EC smokers in the family (yes/no), having friends using EC (yes/no), history of alcohol use (yes/no), and traditional cigarette use (yes/no).

Students' knowledge towards EC was measured using the scale modified from Aghar et al., (2020). The 16-item scale to assess knowledge included the following

statements: (1) ECs are not harmful to human health; (2) ECs are not addictive; (3) ECs are approved by the Vietnamese government; (4) ECs are suitable for young adults; (5) ECs are suitable for pregnant women; (6) Nicotine is present in most ECs; (7) ECs affect others if they inhale EC aerosol; (8) ECs help smokers quit smoking; (9) Harmful flavorings and toxins are found in the EC aerosol; (10) Some components of the liquid found in ECs can cause harmful lung conditions; (11) Swallowing the liquid in ECs accidentally can cause poisoning that is potentially fatal; (12) ECs are associated with lung cancer; (13) ECs are associated with bladder cancer; (14) ECs are associated with heart disease; (15) ECs can impair lung function; and (16) ECs can have an effect on fetal development. Response options included "True", "False", or "Don't know". Each correct answer received "1 point" and incorrect/ "Don't know" response received "0 points". The scale score ranged from 0 to 16. The final score was then dichotomized into "adequate knowledge" and "inadequate knowledge" by assuming a cutoff of 75%. A participant providing correct answers for 75% or more of the questions was considered as having adequate knowledge about EC (Aghar et al., 2020).

Questions on EC use were adapted from previous studies (Lotrean, 2015; Tavalacci et al., 2016) with slight modification to suit the context and actual situation in Vietnam. Participants were asked if they had ever smoked ECs (current use/ever use/never use), what age that they initiated EC use (in years), status of EC use (exclusive use/dual use), where to buy and reasons for initiating EC use, and EC advertising exposure (yes/no).

Current users were participants who had been using ECs in the previous month. Those who had used ECs in the past but not in the previous month were considered former users and students who had never smoked ECs were identified as non-users (Lotrean, 2015).

Dual users were defined as participants who self-identified as current users of both traditional cigarettes and ECs. Exclusive users were participants who reported using ECs only (Lee et al., 2018).

Data analysis

Data was entered into computers using Epidata 3.1 software and analyzed using SPSS version 18. Descriptive analysis, using frequencies (n) and percentages (%), was used to describe EC use patterns. Univariate binary logistic regression and multivariable binary logistic regression models (using the Enter method) were performed to identify factors associated with EC use at a significance level of 0.05.

Ethical consideration

This study was approved by the Institutional Review Board of the Hanoi University of Public Health under the Decision No. 436/2020/YTCC-HD3 dated 17 December 2020. Study information was provided to all participants and signed consent forms were obtained before administering the questionnaire.

Results

General information of participants

A total of 554 undergraduate students participated in the study. The average age of the participants was 20.7 ± 1.4 years. Nearly 90% of participants were male (88.8%) and had average-good academic results (88.2%).

Prevalence of e-cigarette use

Among participants, 13.2% were EC current users, 7.2% were former EC users, and 79.6% were non-users. The percentage of current male EC users (14.0%) was double that of female EC users (6.5%) in this study (Figure 1).

Among current EC users, 56.2% used both traditional cigarettes and ECs, and 43.8% exclusively used ECs. 24.7% of students were daily users. Students initiated EC use at the age of 19. Students purchased ECs from various

sources such as retailers (37.2%), social networks (30.1%), friends or relatives (23%), and e-commerce sites (15.9%).

The most common reasons for EC use were having a friend or family member who used ECs (70.8%), the variety of flavors (34.5%), curiosity (27.4%), the belief that ECs were less harmful than traditional cigarettes (20.4%), and other reasons (Figure 2).

Factors associated with e-cigarette use of participants

Table 1 presents potential factors associated with current EC use. The results of the multinomial logistic regression analyses showed that students having EC users in the family had higher odds of currently using EC than other students (adjusted odds ratio [aOR] = 6.1, 95% confidence interval [CI]: 2.5-15.4; $p < 0.001$). The analysis also revealed that traditional cigarette use (aOR=23.6; 95%CI: 10.5–53.4; $p < 0.001$) and history of alcohol use (aOR=5; 95%CI: 1.6–15.9; $p < 0.01$) were significantly

Table 1. Associations between e-cigarette Current Use and Participants' Characteristic from Univariate and Multivariate Analyses

Characteristics	Total (N=554)		Current EC user (N=73)		Univariate analysis			Multivariate analysis		
	n	%	n	%	OR	95%CI	p-value	aOR	95%CI	p-value
Gender										
Female	62	11.2	4	5.5	Ref			Ref		
Male	492	88.8	69	94.5	2.37	0.83 - 6.72	0.09	0.95	0.26 - 3.53	0.94
Academic year										
1 st - 2 nd year	289	52.1	28	38.4	Ref			Ref		
3 rd - 5 th year	265	47.8	45	61.6	1.91	1.15 - 3.16	0.01 ^a	0.97	0.49 - 1.89	0.93
Academic capacity										
Good - Excellent	320	57.8	29	39.7	Ref			Ref		
Average - Below Average	234	42.2	44	60.3	2.32	1.41 - 3.84	0.001 ^a	1.61	0.82 - 3.17	0.17
Having traditional cigarette smokers in the family										
No	325	58.7	31	42.5	Ref			Ref		
Yes	229	41.3	42	57.5	2.13	1.29 - 3.51	0.003 ^a	0.93	0.46 - 1.87	0.84
Having EC smokers in the family										
No	511	92.2	48	65.8	Ref			Ref		
Yes	43	7.8	25	34.2	13.4	6.82 - 26.3	<0.001 ^a	6.14	2.45 - 15.4	<0.001 ^a
Having friends using ECs										
No	73	13.2	3	4.1	Ref			Ref		
Yes	481	86.8	70	85.9	3.97	1.22 - 12.9	0.014 ^a	2.29	0.58 - 9.04	0.23
Traditional cigarettes use										
No	495	89.4	32	43.8	Ref			Ref		
Yes	59	10.6	41	56.2	32.96	17.0 - 63.7	<0.001 ^a	23.65	10.5 - 53.4	<0.001 ^a
Alcohol use										
No	148	26.7	4	5.5	Ref			Ref		
Yes	406	73.3	69	94.5	7.37	2.64 - 20.6	<0.001 ^a	5.02	1.57 - 15.9	0.006 ^a
EC advertising exposure										
No	189	34.1	10	13.7	Ref			Ref		
Yes	365	65.9	63	86.3	3.73	1.87 - 7.46	<0.001 ^a	2.56	1.11 - 5.9	0.027 ^a
General knowledge towards ECs										
Adequate	195	35.2	18	24.7	Ref			Ref		
Inadequate	359	64.8	55	75.3	1.78	1.01 - 3.12	0.043 ^a	2.22	1.05 - 4.73	0.038 ^a

EC, e-cigarette; OR odds ratio; aOR, adjusted odds ratio; CI, confidence interval; ^aStatistically significant at 0.05

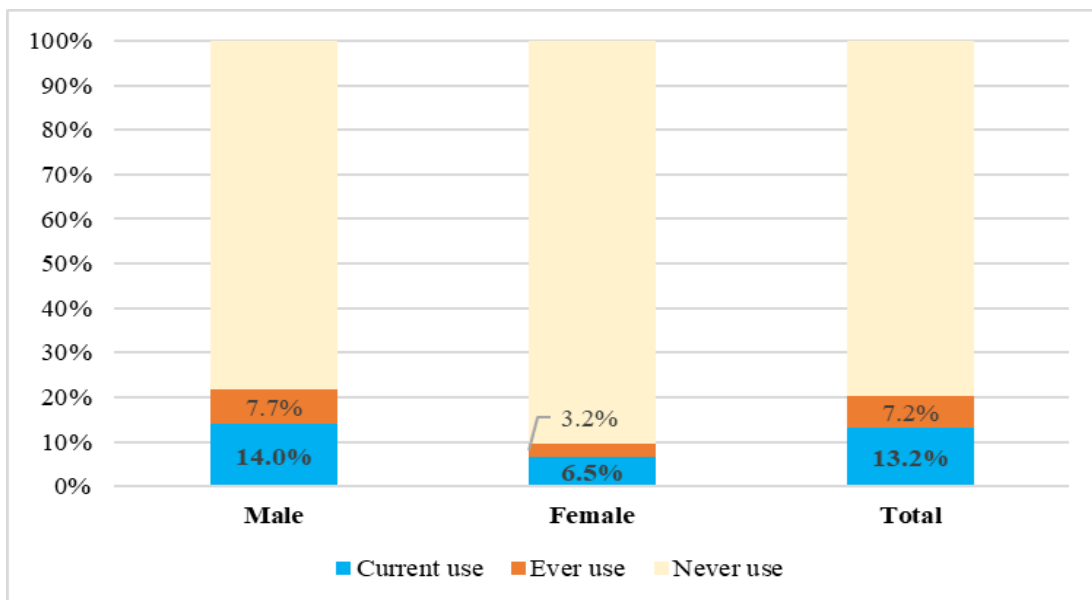


Figure 1. Prevalence of e-Cigarette Use among Participants by Gender

associated with current EC use. In addition, exposure to EC advertisements was significantly associated with increased odds of current EC use (aOR=2.6; 95%CI: 1.11 – 5.9, p<0.01). Students with inadequate knowledge about EC also had higher odds of EC use compared to those with adequate knowledge (aOR = 2.2; 95%CI: 1–4.7; p<0.01).

Discussion

Prevalence of e-cigarette use

Many studies around the world have shown that EC use is common among university students, especially in countries where the use of these products is allowed. The percentage of current EC users in this study was moderate (13.2%). This percentage was similar to the results of previous studies in Slovakia (Babjakova et al., 2020) and New York (Saddleson et al., 2015), but higher than some

studies in Malaysia (Robert Lourdes et al., 2019), China (Wang et al., 2020) and Thailand (Ofuchi et al., 2020).

Currently, in Vietnam, there is no research on EC use among university students. Most studies focus on the use of traditional cigarettes. The percentage of current EC users among university students in this study was much higher than that among young adults (0.2%) in the GATS survey (2015) conducted in Vietnam (Ministry of Health of Vietnam, 2016). EC use became increasingly popular among both genders, particularly young women. The GATS Survey conducted in 2015 reported that the prevalence of EC use was 0.4% among males and 0.1% among females (Ministry of Health of Vietnam, 2016). This rate was found to be much higher in our study in 2021, with prevalence being 14% among male students and 6.5% among female students. This increased use of ECs over time may be attributable to the availability and

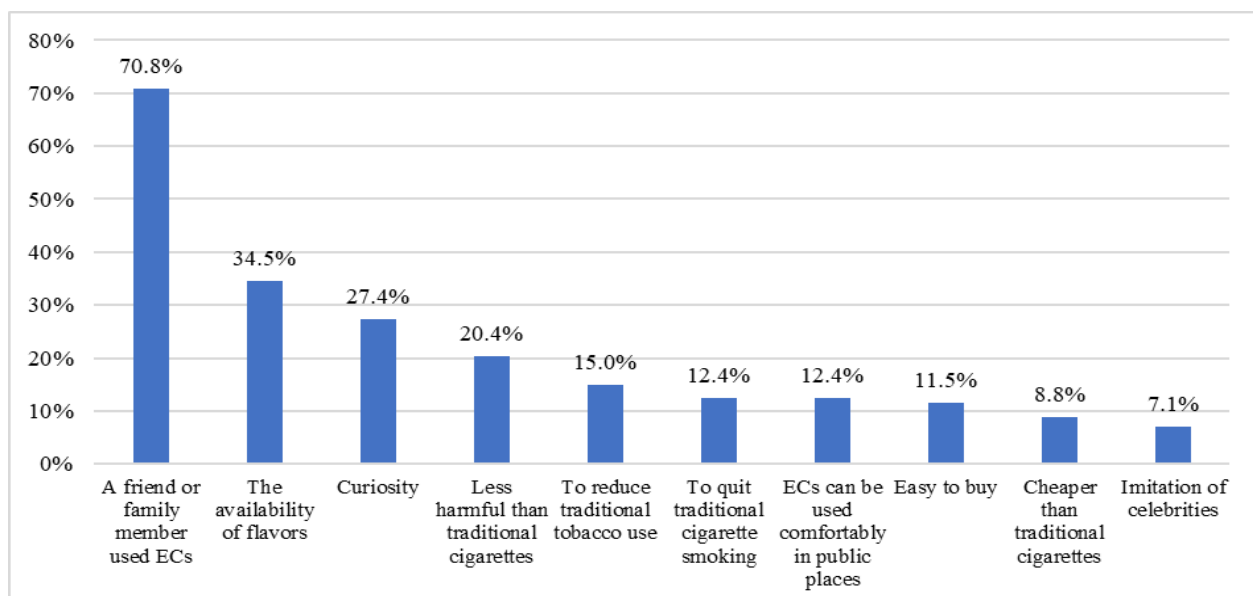


Figure 2. Reasons for Using e-Cigarettes

affordability of these products, particularly in urban areas. Young adults can purchase ECs from various sources, including retailers, social networks, e-commerce channels and friends (Mantey et al., 2019).

In addition, the popularity of EC among young adults may be resulted from a greater exposure to advertisements of these products. ECs are promoted as an alternative safer than traditional cigarettes (Trumbo and Kim, 2015). However, according to the World Health Organization, the scientific evidence regarding the effectiveness of ECs as a smoking cessation aid is inconsistent (WHO, 2020). Many traditional cigarette smokers who used ECs for cessation purposes were unable to quit smoking entirely and became dual users (Cheney et al., 2016). Among current EC users in this study, 56.2% were dual users. This result was higher than the findings from a study conducted by Puteh SEW et al., (2018) in which the percentage of students using both ECs and traditional cigarettes was found to be 40.3% (Puteh et al., 2018). This finding suggested that many study participants did not stop smoking and used both ECs and traditional cigarettes despite cessation of traditional cigarettes being their chief reason for EC initiation. Therefore, strict management of the sale and advertising of EC might contribute to the reduction of EC use, particularly among young people.

Students initiated EC use at the age of 19. This result was similar to the research results of Puteh et al., (2018) in which 54.9% of students participating in the study said that they started smoking ECs at the age of 16–20. Many students started using ECs in their early years of university. Change in learning environment and living conditions during a sensitive stage such as adolescence can bring excitement as well as place pressure on students, both physically and mentally (Puteh et al., 2018).

Reasons for EC initiation were many. In our study, most participants indicated that they started using EC because their friends or family members also used ECs (70.8%). Another study in China reported that students used ECs because they believed that ECs were less harmful than traditional cigarettes (Wang et al., 2019). University students in the United States used ECs because of the novelty and experiential nature of ECs (Sutfin et al., 2013). In Malaysia, most students considered ECs as a smoking cessation tool or a tool to enhance self-image (Puteh et al., 2018). The difference in reason for EC initiation may be attributable to cultural variation among countries. Eastern youth are often concerned with their self-image and are influenced by family and friends, while Western youth tend to value personal choice and experiences.

Although Vietnam's Law on Prevention and Control of Tobacco Harms has been enforced since 1 May 2013, there are no specific regulations on new generation tobacco products in general and ECs in particular (The National Assembly of Vietnam, 2012). Proposing appropriate policies to manage the sale and use of ECs in Vietnam is a major challenge for the Government of Vietnam.

Factors associated with e-cigarette use of participants

Adolescents tend to be influenced by and imitate the

behavior of family members or friends. This study showed that students whose family members smoked ECs had the odd of smoking EC by 6.1 times higher than that of other students (95%CI: 2.4–15.4). This finding was consistent with that of the studies conducted by Almutham et al., (2019) and Wang et al., (2019).

Similar to previous studies (Trumbo and Harper, 2013; Pitriyanti et al., 2018), we found that traditional smoking status was associated with EC use (aOR=23.65; 95%CI: 10.5–53.4). This result was consistent with the high prevalence of dual users in our study which was discussed above. Most EC industries promote the product as a smoking cessation aid or a healthier alternative. Thus, traditional smokers may exert ECs to reduce the number of traditional cigarettes smoked. Besides, ECs are generally more accepted by the public than traditional cigarettes (Trumbo and Harper, 2013).

The study results also showed the impact of EC advertising on EC use among students. Students who had been exposed to EC advertising were more likely to use ECs than other students who had never been exposed (aOR=2.56; 95%CI: 1.11–5.9). These advertisements influence the perceptions and attitudes of both users and non-users of ECs as they perceive EC use as a safer and healthier alternative to traditional cigarette smoking (Trumbo and Kim, 2015). As a result, adolescents may initiate EC use with an incorrect perception about the risks associated with this product.

Alcohol may be a contributory factor in affecting the decision to try smoking cigarettes, ECs, and other substances. History of alcohol use was related to current EC use among university students in this study (aOR=5.02; 95%CI: 1.57–15.9). Studies by Pitriyanti et al., (2018) and Hefner et al., (2020) reported that history of alcohol use was associated with EC use among university students. Alcohol consumption often co-occurs with cigarette use, as their association has long been documented in many previous studies. Alcohol consumption was found to associate with the increased urges to use cigarette products (McKee et al., 2006).

This study showed significant association between current EC use and students' knowledge towards ECs. Students with inadequate knowledge were more likely to smoke ECs than students with adequate knowledge (aOR = 2.22; 95%CI: 1.05–4.73), similar to previous findings (Saddleson et al., 2015; Sutfin et al., 2013). If students do not have adequate knowledge of ECs, they may perceive ECs as a product that is less harmful to health. In addition, the growth of EC advertising increase misperception on the dangers of ECs which leads to EC initiation among students. Therefore, it is necessary to promote communication about the harmful effects of cigarettes in general and ECs to reduce the use of ECs among students.

Limitations of the study

This study has some limitations. Firstly, the study was only conducted among students in one university in Hanoi. Thus, generalization of study findings to other universities in Vietnam should be made with caution.

Secondly, the difference in gender ratio among students at NUCE with a high proportion of male students may contribute to the high prevalence of EC use in our study. The research results may not be an appropriate reference for other settings with different gender pattern. Thirdly, the use of self-administered questionnaires may lead to recall bias or social desirability bias. To reduce this problem, anonymous administration was applied to ensure confidentiality. In addition, teachers were not present during data collection to eliminate any potential influence on students' answers and investigators provided appropriate encouragement for participants to give actual answers. The questionnaire was designed to be student-friendly, and thoroughly tested and adapted before the actual data collection.

In conclusion, EC use is prevalent among university students at NUCE. Factors associated with current EC use include having EC smokers in the family, traditional cigarette use, history of alcohol use, EC advertising exposure and knowledge of students towards EC. Findings from our study emphasize that EC use should be a public health problem and university students are susceptible to engaging in this harmful behavior. Our findings implies the need of strengthening tobacco harm prevention communication in universities so that students can develop an adequate and correct understanding of EC health effects and thus, limit the use of such products.

Author Contribution Statement

The authors confirm contribution to the paper as follow: Le Thi Thanh Huong, Tran Thi Van Anh: Performed writing- original draft and conceptualization; Tran Thi Thu Thuy: Performed writing - methodology, review and editing, conceptualization; Nguyen Quynh Anh: Performed writing - review and editing

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Ethics approval

Ethical permission for this study was obtained in Decision 436/2020/YTCC-HD3 of the Hanoi University of Public Health Ethics Committee dated 17th December 2020.

Conflicts of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in

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