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**A cross-sectional study of cigarette smoking, electronic cigarettes among students of Taras Shevchenko Kyiv National University campus****Shcherbaniuk Ivan, Gnyloskurenko Ganna, Taras Yaremchenko, Nataliia Molochek**

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**Abstract:** *in the modern world, the problem of the spread of nicotine use is defined as one of the key challenges of public health. Against the backdrop of a decrease in the prevalence of tobacco smoking in the world, the prevalence of electronic cigarettes is rapidly growing, and this process is especially active among young people. Since the emergence of electronic cigarettes on the market, their potential harmful effect on health have been actively investigated, but their safety in the medium and long term is still not well known. Thus recent studies in this direction indicate that there are reasons for concern. The purpose of the study is to assess the prevalence of electronic cigarette use and smoking among students of Taras Shevchenko National University of Kyiv, aged 17 to 23, who lived on the campus at the time of the study. The research was conducted by an anonymous survey. The results were evaluated after processing 370 questionnaires using "MedStat" and "IBM SPSS Statistics" software. The results of the study indicate a high prevalence of smoking and e-cigarette use among students, with 50% of respondents smoking cigarettes or e-cigarettes, and 14.1% combining these bad habits. In addition, gender differences in smoking prevalence and patterns were observed. Women more often than men tried to cigarettes (43.7% vs. 32.6%,  $p < 0.05$ ) and electronic cigarettes (39.9% vs. 37.9%), but did not continue smoking them, men smoked cigarettes daily (64.3%) more often than women (38.9%,  $p < 0.01$ ), most of whom smoked cigarettes periodically (61.1%). It was found that smokers are less aware of the harm from cigarettes and electronic cigarettes, compared to non-smokers (77.1% vs. 90.6%,  $p < 0.01$ ). Positive correlations were established between smoking cigarettes and electronic cigarettes ( $r = 0.634$ ,  $p < 0.01$ ), and between personal opinion about the harm to health of cigarettes and electronic cigarettes ( $r = 0.539$ ,  $p < 0.01$ ). The results of the study can serve as a basis for planning further research on this topic, be useful for the development and implementation of practical actions aimed at informing, regulating and controlling the use of electronic cigarettes among young people.*

**Key words:** [Smoking](#), [Electronic Nicotine Delivery Systems](#), [Students](#), [Surveys and Questionnaires](#)**Introduction**

It is known that the prevalence of nicotine use is increasing worldwide, especially among young people (Sanford et al., 2023). At the same time, there are significant changes in nicotine delivery methods. Although tobacco smoking remains one

of the world's biggest public health problems, the proportion of smokers among the world's population has been declining over the past decades. According to "Our World in Data", from 2000 to 2020, the share of smokers over the age of 15 (excluding the use of smokeless tobacco) in Ukraine

decreased by 11.9% (Ritchie & Roser, 2023). At the same time, the prevalence of electronic nicotine delivery systems (ENDS) in the world is growing rapidly. The use of ENDS is often called "vaping" or "smoking electronic cigarettes."

According to a recent study by Global State of Tobacco Harm Reduction, the number of ENDS users in the world increased by 20% from 2020 to 2021, and the total number of ENDS users as of 2022 is about 82 million people (Shapiro, 2022). According to Yoong et al., 2018 a meta-analysis shown an increase in the current use of ENDS among young people in Poland (from 8.2% in 2010 to 29.9% in 2013), and a survey by the University of Michigan among indicates an increase in the prevalence of ENDS as a class of schoolchildren (9% in 8th grade and 25.4% in 12th grade), and over the years (11% among 12th graders in 2017 and 25.4% among 12th graders in 2019) (Miech, Johnston & O'Malley, 2019). The report by Nature presents the results of the use of electronic cigarettes among children aged 13-15 in 75 countries of the world (including Ukraine). According to these results, Ukraine ranks first in terms of current use of ECDS (17.4%), past use of ECDS (36.3%) and awareness of ECDS (93.2%) (Sreeramareddy, Acharya & Manoharan, 2022).

Since the appearance of ESDN on the market in 2003, their potential harmful effects on health have been actively investigated. Attention to this topic has increased dramatically due to the outbreak of vaping-associated pulmonary injury (VAPI) in the United States (Jonas & Raj, 2020). The results of histopathological studies show that cases with VAPI demonstrate the presence of a potential danger associated with the use of uncertified fluids for ENDS, this problem is especially relevant for Ukraine due to the insufficient control over products related to ENDS. Although, it should be noted, that recent positive developments in legislation regarding this issue (Official website of the Parliament of Ukraine, 2023). In addition, electronic cigarettes contain high levels of carcinogens and toxins, which lead to lung cancer, neurological manifestations, cardiovascular disorders and caries (Esteban-Lopez M. & El-Hage N., 2022). The results of a Cochrane community meta-analysis suggest that in the context of smoking cessation efforts, ENDS may be effective and help more

people quit smoking than nicotine replacement therapy, but the number of these studies is limited (Hartmann-Boyce et al., 2022). The medium- and long-term safety issues of ENDS are poorly understood, and recent research in this direction suggests that there are reasons for concern.

### **Aim**

To estimate the prevalence of the use of electronic nicotine delivery systems and tobacco smoking among students of Taras Shevchenko Kyiv National University.

### **Materials and methods**

An anonymous survey of respondents was conducted using the questionnaire method. 386 students aged 17 to 23 took part in the survey. The median age of the students was 19 [IQR 18 – 20], who studied at Taras Shevchenko Kyiv National University (Taras Shevchenko KNU) and lived on the campus of Taras Shevchenko KNU. The questions were answered by students of all courses from 1 to 6.

The questionnaire consisted of three parts: introductory, demographic and main, which included a total of 11 questions. In the introductory part, the anonymity of the answers was guaranteed, the purpose of the study was explained, and the instructions for filling out the questionnaire were provided. The demographic part included questions about the age, course, sex and specialty of the respondent. The main part of the questionnaire included questions about the use of electronic cigarettes, smoking, alcohol consumption, sports, and the respondent's personal opinion about the harm to health caused by smoking, the use of electronic cigarettes, and alcohol consumption. For this publication, answers to questions about alcohol consumption and sports were not used. After the exclusion of incorrectly filled questionnaires, 370 questionnaires remained, the data of which were used to analyze the results. Among them, 238 questionnaires were filled out by women, and 132 were filled out by men. The MedStat software (version 2.6.2. dated 01.22.2019) was used for statistical processing, grouping and analysis of data. Fisher's test (chi-squared test) with Yates's correction was used to compare the percentages of two groups in the context of qualitative characteristics. Spearman's correlation analysis method using IBM SPSS Statistics, 2023 was used to detect the relationship between quantita-

tive characteristics for a non-normal distribution. Multivariate analysis of variance (MANOVA) was performed with the EZR program software version 1.61 (11 November 2022). A significance level of 0.05 (5%) was used to determine the 95% probability interval (95% CI).

To assess the representativeness of the sample (that is, the possibility of spreading the obtained results to a larger number of persons of this category), the general population was calculated as the number of students of Taras Shevchenko KNU, who lived on the territory of the campus, aged 17 to 23 at the time of the study. Taking into account the official data on the number of places in the dormitories (Official website: <https://studmisto.knu.ua/dormitories>), military status and age from 17 to 23 years, the size of the general population is approximately 10,000 students. A simple random sample was used to conduct the survey, so the design effect was equal to 1. The calculation was made according to the formula:

$$\Delta = \sqrt{\frac{1}{n}} * 100 * 1$$

where “n” is the sample (number of participants) who took part in the study. (Bogdan O., 2015).

### Results

When describing the results of the study instead of the term ENDS (electronic nicotine delivery systems) more common term "electronic cigarettes" was used, as indicated in the questions of the survey.

According to the results of the study, among all respondents, 50% (95% CI 44.9-55.1) students smoke or use e-cigarettes, and 14.1% (95% CI 10.7-17.8) combine smoking cigarettes and e-cigarettes. The answers for the questions of the questionnaire of men and women were compared. Among women – 26.9% (95% CI 21.5-32.7) respondents have never smoked cigarettes (C) and electronic cigarettes (EC), among men – 27.3% (95% CI 20.0-35.2). Tried in the past, but currently do not smoke C and EC, statistically more women – 26.5% (95% CI 21.1-32.3), compared to 16.7% (95% CI 10.8-23.5) men (p=0.039). There are 15.9% (95% CI 10.1-22.7) of men and 13.0% (95% CI 9.1-17.6) of women combine C and EC smoking (Fig. 1). In the study, we consider that "smoking" are dai-

ly and periodic smoking of cigarettes or electronic cigarettes (smoking during the last week, month, or year).

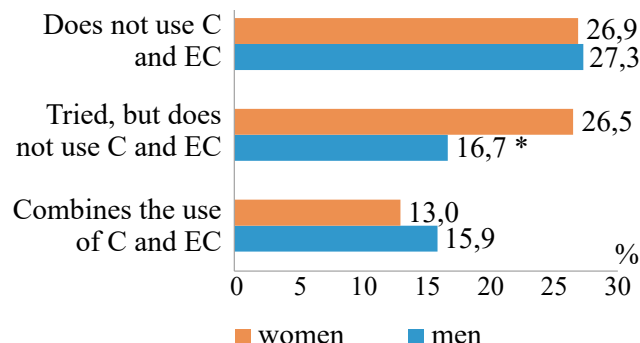


Fig. 1. Use of C and EC among men and women.

Notes: \*p<0.05

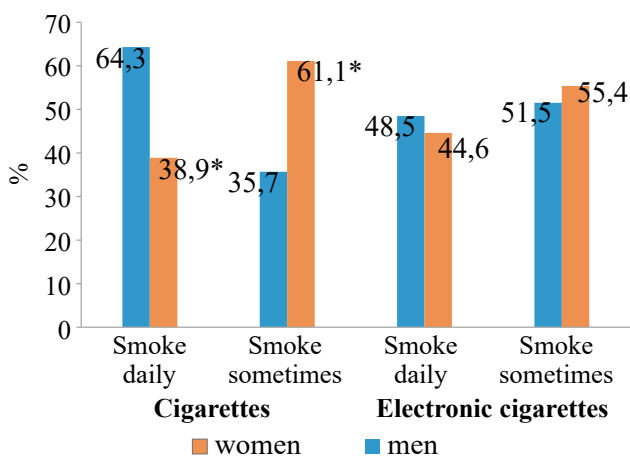
A more thorough assessment of cigarette smoking among men and women revealed that almost the same number of respondents do not smoke cigarettes – 33.6% of women and 35.6% of men. As presented in the table. 1, women chose the answer option "I tried, but I don't smoke" significantly more often – 43.7%, against 32.6% of men (p<0.05). But, among cigarette smokers, there is a trend towards an increase in the number of men (31.8%) compared to women (22.7%), but the difference is statistically insignificant. Evaluating the prevalence of EC use, we observe more homogeneous data in the groups of men and women.

Evaluating subgroups of smokers (i.e. respondents who smoke C or EC), we observe a significant difference in the answers of male and female representatives. Thus, there are significantly fewer cigarette smokers among women – 38.9% (95% CI 32.6-44.9 ) than among men – 64.3% (95% CI 55.0-71.7), and the difference is statistically significant (p<0.001). It is natural that in the group of C smokers, who smoke periodically, there are more women – 61.1% (95% CI 54.7-67.0), than men – 35.7% (95% CI 27.6 – 44.2), p<0.001. This trend is also valid for EC smokers, but the difference between women and men is not statistically significant. (Fig. 2).

Evaluating the personal opinion about the health effects of smoking cigarettes and electronic cigarettes, it was established that the majority of students are aware of the potential harm. To the question "Do you think that smoking cigarettes is

**Table 1.** Characteristics of the use of cigarettes and electronic cigarettes among women and men

Category	Women (n=238)	Men (n=132)	P
<i>Cigarettes</i>			
Haven't tried and don't smoke	33.6% (95%CI 27.8-39.7)	35.6% (95%CI 27.6-44.0)	0.787
Tried, but do not smoke	43.7% (95%CI 37.5-50.0)	32.6% (95%CI 24.8-40.9)	0.046
Smoking	22.7% (95%CI 17.6-28.2)	31.8% (95%CI 24.1-40.1)	0.078
<i>Electronic cigarettes</i>			
Haven't tried and don't smoke	36.6% (95%CI 30.6-42,8)	37.1% (95%CI 29,0-45,6)	1.000
Tried, but do not smoke	39.9% (95%CI 33.8-46.2)	37.9% (95%CI 29.7-46.4)	0.787
Smoking	23.5% (95%CI 18.4-29.1)	25.0% (95%CI 17.9-32.8)	0.849



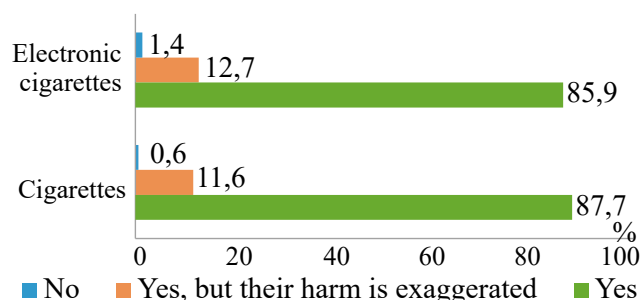
**Fig. 2.** Characteristics of C and EC smoking among men and women

Note: \*p<0.001.

harmful to health?" 87.8% (95% CI 84.3-91.0) respondents answered "Yes". 85.9% (95% CI 82.2-89.3), respondents answered "Yes" to a similar question about harm of EC. However, 11.6% (95% CI 8.6-15.1), students believe that the harm of cigarette smoking and 12.7% (95% CI 9.5-16.3), students of the harm of EC smoking are exaggerated. Some students believe that smoking C and EC does not harm health (Fig. 3). There was no significant difference in the answers between men and women in this aspect.

Interesting results were obtained regarding the harmful effects on health when comparing the answers of a group of students who smoke cigarettes and electronic cigarettes with those who do not smoke (Table 2).

So, 90.6% of respondents who do not smoke cigarettes believe that cigarettes are harmful to health, against 77.1% of those who smoke (p<0.05). At the same time, 22.9% of cigarette smokers are



**Fig. 3.** Opinion about the harm of using electronic cigarettes and cigarettes among all respondents

sure that this harm is exaggerated, which is significantly more than in the group of non-smokers, 7.58% (p<0.05). When comparing the answers of respondents who smoke electronic cigarettes and those who do not smoke them, no statistically significant difference was found.

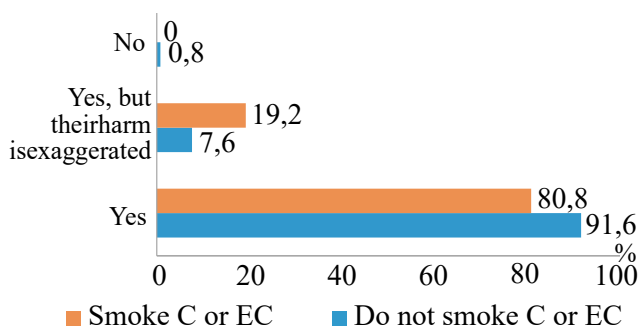
It was established that 88.6%-91.6% of students who do not smoke consider the harmful effects of both cigarettes and electronic cigarettes. 78.8%-80.8% of students who combine smoking cigarettes and electronic cigarettes support the opinion of harmful effects, however, about 20% are sure that their effects are exaggerated (Fig. 4, Fig. 5).

Spearman's correlation analysis established a positive correlation between cigarette smoking and electronic cigarette smoking with r=0.634 (p<0.01), as well as between personal opinion regarding the harm to health C and harm to EC with r=0.539 (p <0.01).

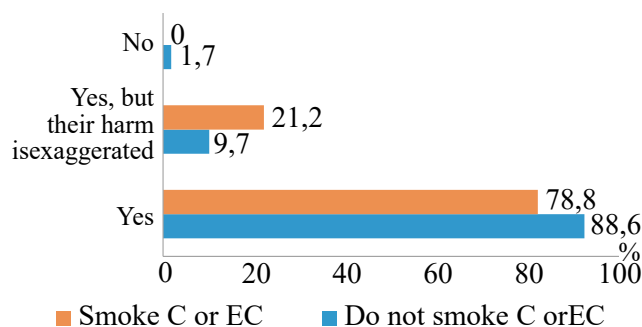
However, using the Multivariate Analysis of Variance (MANOVA) it was confirmed that among the considered factors, only gender (male) and the use of e-cigarettes have a significant effect on daily smoking of cigarettes. Other factors, such as age, level of education, and beliefs about the harm of

**Table 2.** Characteristics of respondents' answers regarding the harm to health of cigarettes and electronic cigarettes among smokers

Respondent's answer	C smokers (n=96)	C non-smokers (n=277)	p
<b>Question: "Do you think that smoking cigarettes is harmful to health?"</b>			
Yes	77.1% (95%CI 68.1-85.0)	90.6% (95%CI 86.9-93.8)	0.003
Yes, but their harm is exaggerated	22.9% (95%CI 15.0-31.9)	7.6% (95%CI (4.8-11.0)	0.001
No	0% (95%CI 0,0-2,0)	0.7% (95%CI 0,1-2,1)	0.984
<b>Question: "Do you think that using electronic cigarettes is harmful to health?"</b>			
Yes	80.2% (95%CI 71.6-87.6)	87.0% (95%CI 82.8-90.7)	0.162
Yes, but their harm is exaggerated	19.8% (95%CI 12,4-28,4)	10.1% (95%CI 6,8-13,9)	0.031
No	0% (95%CI 0,0-2,0)	1.8% (95%CI 0,6-3,7)	0.348
Respondent's answer	EC smokers (n=89)	EC non-smokers (n=281)	P
<b>Question: "Do you think that smoking cigarettes is harmful to health?"</b>			
Yes	85.4% (95%CI 77.2-92.0)	88.6% (95%CI 84.6-92.1)	0.542
Yes, but their harm is exaggerated	14.6% (95%CI 8.0-22.8)	10.7% (95%CI 7.3-14.5)	0.424
No	0% (95%CI 0.0-2.2)	0.7% (95%CI 0.1-2.0)	0.976
<b>Question: "Do you think that using electronic cigarettes is harmful to health?"</b>			
Yes	80.9% (95%CI 72.0-88,4)	87.5% (95%CI 83.4-91.1)	0.181
Yes, but their harm is exaggerated	18.0% (95%CI 10.7-26.7)	11.0% (95%CI 7.6-15.0)	0.145
No	1.1% (95%CI 0.0-4.4)	1.4% (95%CI 0.4-3.1)	0.764



**Fig. 4.** Characteristics of respondents' personal opinion regarding the harm of cigarette smoking among those who do not smoke C or EC and those who combine C and EC



**Fig. 5.** Characteristics of respondents' personal opinion regarding the harm of smoking electronic cigarettes among those who do not smoke C or EC and those who combine C and EC

smoking and the use of e-cigarettes, did not show a statistically significant effect on the dependent variable (Y). (Table 3).

The maximum statistical error for a sample of 370 participants (with a probability of 0.95 and a design effect of 1.0) was: 5.2%. According to the assessment of the representativeness of the sample that was included in the study, it is representative of the general population chosen by us with a probability of 0.95. Taking into account that women and men took part in the questionnaire,

the statistical error of each sample was estimated. Thus, for a sample of 238 women and a sample of 132 men, the statistical errors (with a probability of 0.95 and a design effect of 1.0) were 6.5% and 8.8%, respectively. Considering that the maximum error for sociological research should not be more than 10% (Богдан О., 2015), the results obtained for the samples of women and men are considered representative for students who study at Taras Shevchenko Kyiv National University and live in a campus.

**Table 3.** MANOVA statistical model

	Sum Sq	F value	Pr(>F)
(Intercept) Y	8.944	87.9808	< 2.2e-16 ***
Factor1.X1	0.444	0.7287	0.626780
Factor2.X2	0.594	1.1691	0.323943
Factor3.X3	0.905	<b>8.9045</b>	0.003046 **
Factor4.X4	2.450	<b>24.1037</b>	0.000001406 ***
Factor5.X5	0.010	0.1005	0.751429
Factor6.X6	0.169	0.8299	0.436948

Note: Sum Sq – sum of squares, F value – Fisher's test, Pr(>F) – its significance level. Y – daily smoking of cigarettes, X1 – Age, X2 – level of education, X3 – gender, X4 – EC, X5 – the harm to health C, X6 – the harm to health EC

### Discussion

The results of our study were compared with other studies devoted to the survey of young people among Ukrainian higher education institutions (Пилипів, Л. І., 2023, Корольова, Н. Д., 2019), which demonstrate the prevalence of smoking cigarettes, electronic cigarettes, and their dual use among young people. Among the leading Lviv universities, the consumption of tobacco and nicotine-containing smoking products was 40.7%, among medical students of the Vinnytsia National Medical University, this figure was 38.8%. According to the results of our study, 185 (50%) students smoke or use e-cigarettes, and 52 students (14.1%) combine smoking cigarettes and e-cigarettes. Separately, the consumption of cigarettes was 22.7%-31.8% and electronic cigarettes 23.5%-25.%, depending on gender, which is close to the results of an international study on smoking in different countries of the world, including Ukraine (Sreeramareddy, Acharya & Manoharan, 2022). The revealed statistically significant difference about the predominance of the male gender among smokers compared to the female gender is also confirmed in research in other universities of Ukraine (Пилипів, Л. І., 2023).

### Conclusions

1. It was established that women tried cigarettes and electronic cigarettes more often than men, but did not continue to smoke them.

2. Men are 2 times more likely to smoke cigarettes every day compared to women, most of whom smoke occasionally.

3. When analyzing the personal opinion of respondents regarding the harmful effects of cigarettes and electronic cigarettes on health, students who smoke are less likely to be aware of the harm compared to those who do not smoke. At the same time, about 20% of smokers are sure that this harm is exaggerated.

4. Correlations were established between smoking cigarettes and electronic cigarettes, as well as personal opinion about the harmful effects of cigarettes on health.

5. The results of our study can be useful for further research on the influence of environmental factors on the prevalence of smoking and the use of ENDS among young people, the implementation of practical actions aimed at informing, regulating and controlling the use of ENDS among young people.

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This study did not receive external funding.

### Conflict of interest

The authors declare that there is no conflict of interest and no financial interest in the preparation of this article.

### Consent to publication

All authors have read and approved the final version of the manuscript. All authors have agreed to publish this manuscript.

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## Крос-секційне дослідження куріння сигарет та електронних сигарет серед молоді студмістечка Київського національного університету імені Тараса Шевченка

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*Анотація:* у сучасному світі проблема поширення вживання нікотину визначається як один з ключових викликів громадського здоров'я. На тлі зменшення поширеності у світі тютюнопаління, поширеність електронних сигарет стрімко зростає, особливо активно цей процес відбувається серед молоді. З моменту появи електронних сигарет на ринку, їх потенційний шкідливий вплив

на здоров'я активно досліджується, проте їх безпека у середньостроковій та довгостроковій перспективі досі недостатньо відома, окрім того, останні дослідження в цьому напрямку свідчать про наявність причин для занепокоєння. Метою дослідження була оцінка поширеності використання електронних сигарет та куріння серед студентів Київського Національного Університету імені Тараса Шевченка віком від 17 до 23 років, що проживали на території студмістечка на момент проведення дослідження. Дослідження було проведено шляхом анонімного опитування. Оцінку результатів проводили після обробки 370 анкет за допомогою програмного забезпечення "MedStat" та "IBM SPSS Statistics". Результати дослідження свідчать про значну поширеність куріння та використання електронних сигарет серед студентів, 50% опитаних курять сигарети або електронні сигарети, а 14,1% поєднує ці погані звички. Окрім цього, спостерігалися гендерні відмінності у поширеності та патернах куріння. Жінки частіше чоловіків пробували сигарети (43,7% проти 32,6%,  $p < 0,05$ ) та електронні сигарети (39,9% проти 37,9%), але не продовжували курити їх, чоловіки курили сигарети щоденно (64,3%) частіше за жінок (38,9%,  $p < 0,01$ ), більшість з яких курили сигарети періодично (61,1%). Виявлено, що курці менше усвідомлюють шкоду від сигарет та електронних сигарет, в порівнянні з не курцями (77,1% проти 90,6%,  $p < 0,01$ ). Встановлено позитивні кореляційні зв'язки між курінням сигарет та електронних сигарет ( $r = 0,634$ ,  $p < 0,01$ ), між особистою думкою щодо шкоди здоров'ю сигарет та електронних сигарет ( $r = 0,539$ ,  $p < 0,01$ ). Результати дослідження можуть слугувати підґрунтям для планування подальших досліджень на цю тематику, бути корисними для розробки та впровадження практичних дій націлених на інформування, регуляцію та контроль використання електронних сигарет серед молоді.

**Ключові слова:** куріння, електронні системи доставки нікотину, студенти, опитування та анкетування



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