Vaping Behavior in Young Adults During the COVID-19 Pandemic

Stella L Henn, Mary P Martinasek, and Martin Lange

BACKGROUND: Electronic nicotine delivery systems (ENDS) continue to be popular among young adults. These devices are often advertised as a healthy alternative to quitting tobacco cigarettes. However, young adults represent a population who view it as a novel behavior that provides a sense of popularity, social acceptance, and desired physiologic properties. The objective of this study was to examine characteristics of vaping behavior among college students and explore possible associations between groups of vaping behavior (stopped, initiated, increased, decreased, stayed the same).

METHODS: In a multi-center cross-sectional study, 656 students from University of Tampa in the United States and University of Applied Sciences in Germany (IST) were recruited to answer a 31-item online questionnaire. A chi-square test was used to evaluate associations between the groups.

RESULTS: Prevalence rates indicated approximately 31% of all students were currently using ENDS. Even though more negative than positive experiences with ENDS were reported, most students stated their vaping increased during COVID-19 lockdowns. Addiction and stress relief emerged to be predictors ($P < .001$) of an increase in vaping, whereas social motives were not statistically significant. Living situation ($P = .63$) and depression ($P = .10$) were not significantly associated with vaping behavior.

CONCLUSIONS: ENDS products continue to yield very high levels of nicotine creating addiction in young adults. Addiction counseling and evidenced-based practices should be employed at every level (individual, community, and school). Additionally, mental health counseling for students in pandemic and high-stress environments may help to combat stress in a more proactive manner than self-medicating.

Key words: vaping behavior; young adults; students; electronic cigarette; vaping; dual use; electronic nicotine delivery systems (ENDS); student population; stress relief; social motivation. [Respir Care 0;0(0):1–/C15.

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present. The lifetime prevalence is 30.7% among young adults.24,25 Another study reported a current prevalence (past 30 d) of ENDS between 19.2% (female) and 34.9% (male) for the age group of 18–25 y olds.26 College students in particular increased their ENDS consumption two studies report.26,27 The data on vaping behavior among college students in Germany are generally scarce.

In both Germany and the United States, a significant number of ENDS users also smoke tobacco cigarettes (dual users). In Germany, more than half of ENDS users are dual users (adolescents 59.4%).27 Young adults represent the highest number of dual users at 79.4%.27 In the United States, about 30% of ENDS users account for dual users.28 Comparable data for both countries are overall inadequate.29

There are various reasons why college students start to vape. Advocates of ENDS suggest that vaping aids smoking cessation.29,30 However, young adults who have never vaped have found it to be popular for other reasons. Vaping initiation has been linked to social motivation7,31 and the attraction by a variety of flavors.32 Young adults who have already smoked traditional cigarettes see a healthier alternative in vaping or to quit smoking19,30

Next to the initiation of vaping, the increased use of ENDS is of concern as well. Especially in stressful situations, vapers and smokers tend to increase their nicotine consumption and use it as a coping method.33,34 Stress impacts smoking cessation negatively,7,25 which might cause dual usage or increase the use of ENDS.28 The COVID-19 pandemic was such a stressful event that it had broad effects on students’ health.36-40 The almost worldwide stay-at-home policies forced most universities to transition to online classes only. As a result of these confinements, social isolation impacted students’ health and health behavior.37 Some students were forced to change their living context (ie, moving home to parent[s] or leaving campus) either because they could no longer afford it or due to campus closing.41,42 Deriving from the living situation, social isolation, boredom, and depression are relevant aspects associated with a higher vaping prevalence.43-45 Studies suggest that for most students risky health behavior either increased or stayed the same, regardless of their usual health behavior.39,46-49

**What this paper contributes to our knowledge**

Although young adults surveyed reported more negative than positive associations with vaping, most increased their smoking behavior during the COVID-19 lockdown. Students attributed this to addiction and stress relief. Addiction counseling and mental health counseling need to be more accessible for the target group.

The effects of ENDS on health, especially young adults, are of growing interest in recent years but have not been adequately studied yet since longitudinal data are relatively limited.50,51 Vaping can have severe effects on the pulmonary system as shown by the cases of e-cigarette or vaping product use–associated lung injury.6,52 Next to liquid nicotine, flavoring chemicals with propellants of propylene glycol and glycerin,53,54 vape devices contain toxicants, ultrafine particles, and carcinogens imposing serious health risks that in most cases are not declared on vaping labels.3,4,55 Nicotine itself is highly addictive56 and in high doses can impact the development of the brain among young adults significantly. Potential long-term effects on brain developments can already be caused by low doses of nicotine exposure affecting cognitive functions56,57 and lead to problematic levels of nicotine use.56,58,59 Further, studies report reduced pulmonary immune function60 and cardiovascular effects such as an elevated heart rate and diastolic blood pressure with these products.61

ENDS are advertised as safe, which leads to a higher consumption and an unwillingness to quit.5,26 Especially in young adults, nicotine exposure through vape devices is often higher than among adults who smoke combustible cigarettes exclusively.1,62 In turn, the higher consumption can lead to serious health risks. To reduce vaping and promote healthy behavior among college students, it is important to gain insights in the characteristics of vaping behavior and potential stressors such as the COVID-19 pandemic and other predictors. Against this background, the aims of the study were (1) to characterize the vaping behavior of students at two universities during the COVID-19 pandemic; and (2) examine potential correlates of observed vaping patterns, including depression, living situation, and reasons for vaping.

**QUICK LOOK**

**Current knowledge**

Vaping is more popular than ever among young adults. Although electronic nicotine delivery systems are advertised as a healthy alternative to smoking regular tobacco, they contain high levels of nicotine as well as carcinogens. Regardless of its potential health hazards, vaping gives young adults a sense of popularity and social acceptance and is, therefore, considered a gateway drug.

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The authors have disclosed no conflicts of interest.

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Methods

For data collection, an observational, cross-sectional study design with a convenience sample was designed by the University of Tampa (UT, Florida) and the IST University of Applied Sciences (IST, Düsseldorf, Germany) following the Standards of Reporting of Observational Studies in Epidemiology guidelines. The institutional review board of the UT and the IST approved the study design and the data collection.

The target group included all students (undergraduate and graduate) who were enrolled in one of the two universities at the time of the survey (February 2021). Age restrictions did not apply. Lastly, every individual (eg, staff or friends of students) who claimed not to be a student was excluded. The data were collected from voluntary participants through an online survey link shared at both universities through a mailing service. Each participant had to provide consent before engaging in the survey.

The 31-item self-reported questionnaire assessed demographic characteristics (age, sex, ethnicity, and university location), type of vaping products, vaping behavior, vaping experience, reasons for vaping, and associated factors (living situation and depression). The questionnaire had been tested and used in previous studies. The survey items were translated carefully following established guidelines.

First, participants were asked to describe their vaping behavior since the lockdown. Answer options were: I have stopped, increased, decreased, started vaping, stayed the same, or other. Second, participants had to describe whether their access to vaping devices during the pandemic was easier, more difficult to get, or about the same. Third, negative and positive experience were assessed with various categorical answer options from none to make me feel good; or addiction, nausea and vomiting, or discomfort in the chest. The reasons for vaping were assessed by categorical answers such as relieve stress, friends vaping, boredom, or lose weight. Regarding the living situation, we asked participants if the housing situation best described as stayed on campus (non-independent), stayed off campus (independent), returned home (non-independent), switched from independent to non-independent, switched non-independent to independent, or other.

Depression was assessed with the 9-item depression module from the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 is a multilingual, valid, and reliable instrument used to detect different severities of depression. Answers range from not at all (0) to nearly every day (3), cumulating to the PHQ-9 score between no depression (0–4), mild depression (5–9), moderate depression (10–14), moderate-severe (15–19), and severe depression (20–27). Vaping behavior was the main outcome and dependent variable. Reasons for vaping were independent variables with age as a confounder.

To determine the power of the analysis, we used G*Power (version 3.1), assuming a priori a medium effect size (ω = 0.3), a margin of error of 5%, and a power of 0.5 (1-β error probability). The required sample size was n = 185, with a critical chi-square of 55.7 for the 2 variables with the most degrees of freedom (df (df = 40).

Data were checked for plausibility and missing values. Further, a 2-step descriptive analysis was performed. First, the total sample was assessed for demographic parameters. A second analysis included ENDS users only. For the ENDS user sample, we assessed demographics, access to vaping devices, positive/negative/unexpected experiences, and use of other vape products. We applied a t test for unpaired samples to compare depression scores between ENDS users and non-users. A chi-square test was used to evaluate associations between vaping behavior and the independent variables (reasons of vaping, living situation, depression score). Additionally, we calculated the effect size using Cramer phi (φ). For all statistical analyses, SPSS Statistics 28 (IBM, Armonk, New York) was used.

Results

Before data cleaning, we counted a total of 901 respondents. Of the 656 included respondents, 22.6% were male, 72% female, and 0.6% gender nonconforming. None identified as transgender. In total, 70.7% of the respondents were from the United States. The total sample (n = 656) split into 203 ENDS users and 453 non-users. The respondents’ demographics indicate that most identified as white (86.3%). Hispanic/Latino (4.4%) and multi-ethnic (4%) respondents were represented in smaller shares. Black/African and other European regions accounted for 1.5% each. The rest (2.3%) of the respondents identified with other ethnicities. The mean age of the total sample was 22 ± 4.3 y. Of the total sample, 192 UT respondents (n = 464, 41.4%) claimed that they vaping in the past 30 d before the survey was conducted, and 11 IST respondents (n = 192, 5.7%) were using ENDS. Within the 203 ENDS users, 70.9% identified as female, 24.6% as male, and 1% as gender nonconforming. With 20.6 ± 2.7 y of age, the mean age of the ENDS user group was slightly less than the total sample. All respondents from the IST identified as white (90.9%, 10 respondents). This applied for most respondents (83.9%) from the United States as well (see Table 1).

Vaping behavior, influences, and physiological experiences regarding either the period the universities went online or the past 30 d (in which the universities’ classes were online as well) were evaluated (Table 2). Most respondents claimed that they increased their vaping since the universities went online (47.3%), whereas...
Table 1. Demographics of Total Sample and Electronic Nicotine Delivery Systems Users Combined and Separate for United States and Germany

<table>
<thead>
<tr>
<th>Age, y*</th>
<th>Total sample</th>
<th>United States</th>
<th>Germany</th>
<th>Total of subsample</th>
<th>United States</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.1 ± 2.4</td>
<td>21.9 ± 2</td>
<td>22.8 ± 3</td>
<td>21.9 ± 2</td>
<td>22.8 ± 3</td>
<td>21.3 ± 3</td>
<td>21.9 ± 2.6</td>
</tr>
<tr>
<td>Group differences†</td>
<td>$P &lt; .001$</td>
<td>$P &lt; .001$</td>
<td>$P = .072$</td>
<td>$P = .001$</td>
<td>$P = .001$</td>
<td>$P = .041$</td>
</tr>
<tr>
<td>Location</td>
<td>656 (100)</td>
<td>464 (70.7)</td>
<td>192 (29.3)</td>
<td>203 (100)</td>
<td>192 (94.6)</td>
<td>11 (5.4)</td>
</tr>
<tr>
<td>Sex</td>
<td>644 (98.3)</td>
<td>452 (70.2)</td>
<td>192 (29.8)</td>
<td>196 (96.6)</td>
<td>185 (94.4)</td>
<td>11 (5.6)</td>
</tr>
<tr>
<td>Male</td>
<td>168 (26.1)</td>
<td>114 (25.2)</td>
<td>54 (28.1)</td>
<td>50 (25.5)</td>
<td>46 (24.9)</td>
<td>4 (36.4)</td>
</tr>
<tr>
<td>Female</td>
<td>472 (73.3)</td>
<td>334 (74.9)</td>
<td>138 (71.9)</td>
<td>144 (73.5)</td>
<td>137 (75)</td>
<td>7 (36.6)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>644 (98.3)</td>
<td>452 (70.2)</td>
<td>192 (29.8)</td>
<td>196 (96.6)</td>
<td>185 (94.4)</td>
<td>11 (5.6)</td>
</tr>
<tr>
<td>White</td>
<td>566 (86.3)</td>
<td>381 (82)</td>
<td>185 (96.4)</td>
<td>171 (84.2)</td>
<td>161 (83.9)</td>
<td>10 (90.9)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (1.5)</td>
<td>6 (1.3)</td>
<td>4 (2.1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Black/African</td>
<td>10 (1.5)</td>
<td>6 (1.3)</td>
<td>4 (2.1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>29 (4.4)</td>
<td>29 (6.3)</td>
<td>0</td>
<td>10 (4.9)</td>
<td>10 (5.2)</td>
<td>0</td>
</tr>
<tr>
<td>Multi-ethnic</td>
<td>26 (4)</td>
<td>26 (5.6)</td>
<td>0</td>
<td>8 (3.9)</td>
<td>8 (4.2)</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>15 (2.3)</td>
<td>12 (2.6)</td>
<td>3 (1.6)</td>
<td>10 (4.9)</td>
<td>9 (4.7)</td>
<td>1 (9.1)</td>
</tr>
</tbody>
</table>

Data are presented as n (%) unless otherwise indicated.

*Data are presented as mean ± SD.

†Group difference between comparable groups of All and ENDS only.

ENDS = Electronic nicotine delivery systems

16.3% decreased their vaping. Few respondents claimed there was no change in their vaping behavior (10.3%), whereas only 6.9% stopped.

For positive and negative experiences, multiple answers were allowed. A total of 376 responses were positive experiences. Of the ENDS user group, 26.1% claimed that they had no positive experience. The most reported positive experiences were nicotine high (34.5%), head rush (33.0%), and that vaping helps them concentrate (22.2%).

A total of 576 responses were negative experiences within the past 30 d, of which 47 (23.2%) claimed to have none. The most reported positive experiences were nicotine high (34.5%), head rush (28.1%), and that vaping helps them concentrate (22.2%).

For this study, we assessed association between the groups of behavioral characteristics (ie, stopped, increased, decreased, started vaping, no change, or other, looking back at past 30 d) and reasons for vaping, living situation, and depression. As seen in Table 3, the outcomes identified stress relief (n = 28) and addiction (n = 44) as primary reasons for those that increased smoking. For those that started vaping for the first time, weight loss was also the most common reason (n = 16), followed by others (see Table 3). As for the living situation, most stayed in their non-independent housings. Cross-tabulated with the groups of behavioral characteristics, these findings were not significant (P = .63). Only 6 respondents claimed they moved to non-independent housing (ie, parent[s]), and even fewer (n = 2) switched between independent and non-independent.

Finally, the depression score of the groups was assessed. These findings were not statistically significant (P = .10). Overall, the subjects varied on the scale of minimal, mild, moderate, moderately severe, or severe depression (see Table 3). Most clustered in the category of mild depression (n = 73), and the least in severe depression (n = 17). Differences between the 2 countries were not specifically assessed due to the uneven distribution of ENDS users. The depression score revealed no significant difference between the ENDS users and non-users (P = .23).
VAPING BEHAVIOR IN YOUNG ADULTS DURING COVID-19

Table 2. Prevalence of Vaping-Related Information of Electronic Nicotine Delivery Systems Users Only

<table>
<thead>
<tr>
<th></th>
<th>(n = 203)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which of the following best describes your vaping behavior since UT/IST went online?</td>
<td></td>
</tr>
<tr>
<td>I have stopped vaping</td>
<td>14 (6.9)</td>
</tr>
<tr>
<td>I have increased my vaping</td>
<td>96 (47.3)</td>
</tr>
<tr>
<td>I have decreased my vaping</td>
<td>33 (16.3)</td>
</tr>
<tr>
<td>I have started vaping for the first time</td>
<td>11 (5.4)</td>
</tr>
<tr>
<td>My vaping stayed the same</td>
<td>28 (13.8)</td>
</tr>
<tr>
<td>Other</td>
<td>21 (10.3)</td>
</tr>
</tbody>
</table>

In the past 30 d, how has your access to vape devices been?

- Easier: 55 (27.1)
- More difficult to get: 7 (3.4)
- About the same: 140 (69)

What positive experiences have you had with vaping in the past 30 d? (Choose all that apply)

- None: 53 (26.1)
- Makes me popular: 2 (1)
- Makes me feel cool: 4 (2.1)
- Throat hit: 29 (14.3)
- Head rush: 67 (33)
- Nicotine high: 70 (34.5)
- Lose weight: 12 (5.9)
- Helps me concentrate: 45 (22.2)
- Gives me energy: 12 (5.9)
- Helps me fit in: 2 (1)
- Helps me get off other products: 8 (3.9)
- Suppress my appetite: 36 (17.7)
- Love the flavor: 36 (17.7)

What unexpected/negative experiences have you had with vaping in the past 30 d? (Choose all that apply)

- None: 47 (23.2)
- Dizziness: 36 (17.7)
- Increased heart rate: 36 (17.7)
- Short of breath: 45 (22.2)
- Discomfort in the chest: 38 (18.7)
- Coughing: 49 (24.1)
- Throat hurt: 29 (14.3)
- Headache: 45 (22.2)
- Stomachache: 20 (9.9)
- Tired: 27 (13.3)
- Addiction: 96 (47.3)
- Irritable: 26 (12.8)
- Cost: 63 (31)
- Nausea and vomiting: 19 (9.5)

In the past 30 d, which products have you used?

- None: 60 (29.6)
- Regular cigarettes: 24 (11.8)
- Cigarillos: 2 (1)
- Vape with THC: 20 (9.9)
- Hookah: 3 (1.5)

(Continued)

Table 2. Continued

<table>
<thead>
<tr>
<th></th>
<th>(n = 203)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joints/pipe</td>
<td>49 (24.1)</td>
</tr>
<tr>
<td>Dab cartridges</td>
<td>12 (5.9)</td>
</tr>
<tr>
<td>Other</td>
<td>5 (2.5)</td>
</tr>
</tbody>
</table>

Data are presented as n (%) or mean ± SD.

UT = University of Tampa
IST = IST-University Applied Sciences
THS = tetrahydrocannabinol

Discussion

The study evaluated vaping behavior of students at two universities during the COVID-19 pandemic and examined potential correlates of observed vaping patterns. The results revealed that about one third of all students were currently using ENDS. Even though more negative than positive experiences with ENDS were reported, most students stated their vaping increased during COVID-19 lockdowns. Addiction and stress relief emerged to be significant predictors of an increase in vaping, whereas social motives, living situations, and depression were not statistically significant.

Respondents claimed that they either increased their vaping or experienced no change in vaping. These findings are similar to descriptive COVID-19 studies concerning self-reported smoking and vaping patterns.\(^8,72-75\) Possible explanations can be seen in increased stress situations and anxiety, social isolation, and addiction.\(^30\) Whereas some studies report stress relief as a major reason to increase vaping, nicotine addiction is less frequently reported.\(^30,34,76\) Our results show that those who predominately increased vaping also identified stress relief and addiction as the main reason for vaping in the past 30 d. However, the roles of stress and addiction remain unclear. Stress can be a result of external factors such as the COVID-19 pandemic and lead to addiction. At the same time, it is argued that stress can be a result of an attempt to quit.\(^34\) The relationship between stress, addiction, and vaping behavior should be investigated in future research.

Most students reported that they stayed in independent housing situations during the lockdown, where smoking and vaping regulations might be less constraining than in non-independent housings (ie, parent[s]). Staying in usual, less regulated surroundings and having access to shops might contribute indirectly to maintaining or increasing vaping rituals in elevated stress situations.\(^41,42,44\) The cheap cost of the product could be another access-related reason that promotes ENDS use.\(^31,77\) However, in the presented study, it was the second-highest negative experience reported, which might have been due to the facts that students mostly have little additional income and many lost their jobs as a consequence of COVID-19 pandemic restrictions.\(^77\) Coughing and addiction were the highest-rated
negative experiences, which underlines the importance of warnings from several health-related organizations that ENDS can have a hazardous impact on the pulmonary system and high doses of nicotine fuel addictive behavior.\textsuperscript{52,78,79} Also, the relevance of negative experiences might weigh higher as the average number of selections were higher than positive experiences.

Reported positive experiences were primarily nicotine high, head rush, and better concentration. As ENDS contain very high rates of nicotine, these findings seem plausible and align with other studies.\textsuperscript{80,81} The third-most selected response claimed there were no positive experiences, pointing to a social motivation when using ENDS (eg, vaping with friends).\textsuperscript{82} This aspect is not supported by the reasons reported for vaping in our study but aligned with other findings.\textsuperscript{29,30,83} Only a few indicated social reasons such as friends vaping or popularity.\textsuperscript{6,59,65} These findings correspond with the consequences of the COVID-19 pandemic, which were among other things stressful and few social contacts.

Multiple studies show that an increased frequency of vaping is strongly associated with incrementally higher odds of depression.\textsuperscript{82,84-86} This tendency can only be surmised looking at the presented results (\( n = 24 \) reported moderately severe and severe depression while showing an increased vaping behavior). Overall, the findings of this study did not confirm this association statistically.

ENDS users were significantly younger, which is another important aspect when it comes to prevention strategies. As younger adults and teenagers are more prone to marketing activities, producers of ENDS have focused specifically on them as a main target group.\textsuperscript{31} This aspect offers an important indication for devising a purposive prevention strategy.

Lastly, the results revealed a huge disparity between United States and German ENDS users. The reasons for this cannot be explained causally. Possible explanations may lie in the legal regulation. As age restrictions are higher in the United States (21 years of age), taxes and higher prices might be a reason. In Germany, ENDS are regarded as substitutes for tobacco and are, therefore, highly taxed.\textsuperscript{87} Future research should investigate how price regulations and limited access contribute to a behavior change regarding the consumption of ENDS.

This study underlines the necessity for health promotion policies and target group-specific interventions to focus on ENDS-related subjects. First, during a more and more globalized world, international data on health-related subjects are important for developing global and regional health promotion strategies.

### Table 3. Associations of Vaping Behavior and Reasons for Vaping, Living Situation, and Depression

<table>
<thead>
<tr>
<th>Reasons for vaping, past 30 d</th>
<th>Stopped Vaping</th>
<th>Increased Vaping</th>
<th>Decreased Vaping</th>
<th>Initiated Vaping</th>
<th>No Change</th>
<th>Other</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Relieve stress</td>
<td>1</td>
<td>28</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Trying to quit cigarettes or other products</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Friends vaping</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Looks cool</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Addicted</td>
<td>2</td>
<td>44</td>
<td>9</td>
<td>3</td>
<td>12</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Lose weight</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Flavors</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>To try it</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Boredom</td>
<td>1</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td></td>
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<table>
<thead>
<tr>
<th>Living situation</th>
<th>.63</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>0</td>
</tr>
<tr>
<td>Stayed independent</td>
<td>12</td>
</tr>
<tr>
<td>Moved to non-independent</td>
<td>1</td>
</tr>
<tr>
<td>Switched between non- independent/independent</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHQ-9 score</th>
<th>.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal depression to none</td>
<td>7</td>
</tr>
<tr>
<td>Mild depression</td>
<td>4</td>
</tr>
<tr>
<td>Moderate depression</td>
<td>1</td>
</tr>
<tr>
<td>Moderately severe depression</td>
<td>1</td>
</tr>
<tr>
<td>Severe depression</td>
<td>1</td>
</tr>
</tbody>
</table>

Data are presented as \( n \).

PHQ-9 = Patient Health Questionnaire-9
strategies. Second, the results of this study emphasize the need for interventions especially for smokers and ex-smokers prone to relapse in highly stressed situations to prevent an increase in the use of ENDS. In this context, the role of stress needs to be further investigated. Third, the results reveal a need for strategies and interventions to prevent further addictive behavior as vaping is a gateway to nicotine addiction.

Limitations

The presented study shows several strengths such as its exploratory nature and the collection of 2 data sets from 2 different countries during the COVID-19 pandemic. At the same time, there are some limitations, which have to be taken into account interpreting the results. The sample size, especially with regard to the number of ENDS users in the German sample, is small, which limits the generalizability and comparability. The response rate in relation to all enrolled students can be interpreted as small. This might be due to different e-mail settings as students did not have to use their university address that the survey was mailed to. Also digital tiredness can be a reasonable explanation for not participating in online surveys. Data were assessed retrospectively, which left answers vulnerable for distortion. Moreover, socially desirable responses are more likely with self-report assessments, so a question was added in which the honesty of the answers was assessed. A non-responsive bias cannot be excluded for some of the data sets. In order not to exceed the scope of this paper, no special attention was paid to country-specific statutory regulations with regard to lockdowns and the promotion of ENDS. Finally, the study design allows no causal implications.

Conclusions

This study underlines the shift in reasons for vaping from a seemingly social motivation to an addictive method for stress relief. Future research should focus on the relationship of stress and addiction. At the same time, universities and health professionals should address these issues in support groups or through counseling and develop strategies that offer college students healthy alternatives.

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